Complete Summary

GUIDELINE TITLE

Access device guidelines: recommendations for nursing practice and education.

BIBLIOGRAPHIC SOURCE(S)

Oncology Nursing Society (ONS). Access device guidelines: recommendations for nursing practice and education. 2nd ed. Pittsburgh (PA): Oncology Nursing Society (ONS); 2004. 141 p. [433 references]

GUIDELINE STATUS

This is the current release of this guideline.

This guideline updates a previous version: Oncology Nursing Society (ONS). Access device guidelines: recommendations for nursing practice and education. Pittsburgh (PA): Oncology Nursing Society; 1996. 83 p.

COMPLETE SUMMARY CONTENT

SCOPE
METHODOLOGY - including Rating Scheme and Cost Analysis
RECOMMENDATIONS
EVIDENCE SUPPORTING THE RECOMMENDATIONS
BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS
CONTRAINDICATIONS
QUALIFYING STATEMENTS
IMPLEMENTATION OF THE GUIDELINE
INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES
IDENTIFYING INFORMATION AND AVAILABILITY
DISCLAIMER

SCOPE

DISEASE/CONDITION(S)

- General:

  Cancer and other diseases or conditions associated with the use of devices to access the venous, arterial, peritoneal, or intraventricular/epidural body system

- Specific:

Thromboembolic disease, diabetes mellitus, chronic osteomyelitis, severe spasticity, renal disease, and Parkinson's disease

GUIDELINE CATEGORY

Management
Treatment

CLINICAL SPECIALTY

Nursing
Oncology
Pediatrics

INTENDED USERS

Advanced Practice Nurses
Nurses

GUIDELINE OBJECTIVE(S)

- To describe the different types of access devices available, their advantages and disadvantages, patient selection criteria, the use of access devices, and techniques of insertion
- To describe the special features, maintenance, and care of each type of access device
- To describe potential complications associated with each type of access device
- To list nursing interventions for monitoring and treating access device complications
- To identify the learning needs of and resources for patients and care providers related to each type of access device
- To describe controversial issues associated with access devices
- To describe documentation procedures recommended for access devices
- To describe educational needs and clinical competency for RNs providing care to patients with an access device
- To describe anatomic and physiologic parameters influencing placement and management of access devices
- To describe the significance of vein selection and catheter size/catheter material used in relation to complications

TARGET POPULATION

Adult and pediatric patients with cancer

INTERVENTIONS AND PRACTICES CONSIDERED

1. The use of access devices, including vascular access devices, arterial access devices, intraventricular access devices, epidural and intrathecal access devices, intraperitoneal catheters, and implantable pumps
2. Patient selection criteria and techniques of insertion
3. Removal techniques

4. Maintenance and care of each type of access device
5. Nursing interventions for monitoring for and treating access device complications
6. Identifying the learning needs of and resources for the patient and care provider related to each type of access device

MAJOR OUTCOMES CONSIDERED

- Quality of life
- Complication rates and types associated with the use of access devices

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

The guideline developer performed literature searches using Medline, CINAHL (Cumulative Index to Nursing and Allied Health), and Index Medicus.

NUMBER OF SOURCE DOCUMENTS

Not stated

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Expert Consensus

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Not applicable

METHODS USED TO ANALYZE THE EVIDENCE

Review

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

Not stated

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Not stated

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Not applicable

COST ANALYSIS

Cost overviews are provided for each of the access devices.

METHOD OF GUIDELINE VALIDATION

External Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

The current document was written and edited by experts in the field. The content/field review was done by seven additional reviewers.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

For an overview of vascular access devices (VADs) including materials, costs, usages, maintenance and care, removal, and complications, see the original guideline document.

Vascular Access Devices

Peripheral Intravenous (IV) Catheters

1. Description and types of catheters (See the original guideline document for full details.)
2. Advantages and disadvantages of using a peripheral IV (See Table 6 in the original guideline document for full details.)
3. Patient selection criteria
    a. Patient's age, in general, does not restrict use of peripheral IV.
    b. Indications for peripheral IV include the following.
        1. With adequate vascular integrity, peripheral IVs are recommended for short-duration, nonirritating infusions of less than seven days, which may include antimicrobials, analgesics, blood components, fluid and electrolyte replacement, and nonvesicant chemotherapy (Barton et al., 1998).
        2. Peripheral IVs are best used for simple, one-time-use IV therapies, such as administering an IV push of a vesicant or nonvesicant chemo-therapy, because the IV is inserted only at the time of therapy and usually is discontinued immediately after the procedure is complete.
        3. Patients with a short life expectancy are candidates for peripheral IVs.
        4. Peripheral IVs are not indicated for continuous vesicant therapy or highly concentrated solutions.
        5. Using peripheral IVs for blood specimens has mixed recommendations.

a. They are not to be used for routine blood drawing (Intravenous Nurses Society [INS], 2000).
b. Within certain limitations of infusate, peripheral IVs can be used for blood sampling for many routine tests, including coagulation studies, with reliable results (Arrants et al., 1999; Himberger & Himberger, 2001; Mohler et al., 1998; Powers, 1999).
c. There are no definitive guidelines on blood sampling from peripheral IVs; research still needs to be done in this area. Additionally, weighing the benefits and risks of safety, costs, and comfort to the patient may aid in decision making.

c. Vein selection
    1. The vein selected should be based on the type of fluid to be infused and the rate and duration of infusion. Ideally, it should not interfere with the patient's comfort or mobility.
    2. Preferred sites
        a. Upper extremity veins in adults; these may include the superficial dorsal and metacarpal veins on the dorsum of the hand as well as the cephalic and basilic veins, and cephalic, basilic, and median veins on the upper arm (see Figure 1 in the original guideline document).
        b. Hand veins have a lower risk of phlebitis than veins on the wrist or upper arm (O'Grady et al., 2002; Perry & Potter, "Intravenous and vascular access", 2002; Weinstein, "Anatomy and physiology," 2001).
        c. Select the most distant site possible, but proximal to previous venipuncture.
    3. Sites to avoid
        a. Avoid extremities/sites that have impaired circulation or injury, such as lymphedema, postoperative swelling, recent trauma, hematoma, axillary lymph node dissection, local infection, phlebitis, or open wounds; also avoid extremities where venipuncture has been performed within the last 24 hours, if possible (Fischer, Knobf, & Durivage, 1997).
        b. Lower extremities are associated with higher risk of infection than are upper extremities (O'Grady et al., 2002; Weinstein, "Anatomy and physiology," 2001) and more likely to develop thrombophlebitis. Physician order is recommended when using a lower extremity, but more importantly, nurses should consult with physician regarding central line placement or other alternatives prior to using the lower extremity (Weinstein, "Anatomy and physiology," 2001). Replace lower-extremity IV catheter as soon as it is feasible (O'Grady et al., 2002).
        c. Skin changes and changes in the integrity of the vein lumen associated with radiation, prior chemotherapy, or prior IV therapy can make catheter insertion or site care difficult.

d. Antecubital veins are not recommended because of the difficulty of detecting infiltration and because they are located on an area of flexion (Ellenberger, 1999).

d. Catheter or device selection
    1. Use the smallest-gauge device that will successfully deliver the prescribed therapy at the desired rate.
    2. Select catheter based on intended purpose, expected length of therapy, viscosity of fluid, fluid components, and condition of vein.
    3. Avoid use of steel needles for administration of fluids and medications that may cause tissue necrosis if extravasation occurs (O'Grady et al., 2002); limit steel needles to short-term or single dose administration (INS, 2000) or one-time infusion and IV push only (Perry & Potter, "Intravenous and vascular access," 2002, "Parenteral medications," 2002).
    4. Considerations for gauge selection include the following.
        a. 16-18 gauge for major surgery
        b. 18-20 gauge for rapid infusion of IV fluids, blood components, or viscous medications (Perry & Potter, "Intravenous and vascular access, 2002, "Parenteral medications," 2002)
        c. 20 gauge for most IV applications and for blood products
        d. 22-24 gauge with ¾-inch catheter for elderly patients: Short length and small gauge is less traumatizing, reduces irritation, and permits better blood flow (Weinstein, "Intravenous therapy," 2001; Whitson, 1996); 24 gauge can infuse up to 250 ml of fluid per hour (Masoorli, 1997).
    5. Obese patients with veins deep in the subcutaneous (SC) tissue may need slightly longer peripheral IV catheters, or consider a peripherally inserted central catheter (PICC) as the catheter of choice (Gallagher, 1999).

4. Overview of insertion techniques (Perry & Potter, "Intravenous and vascular access," 2002)
    a. Conduct preplacement assessment to determine if peripheral IV access is appropriate.
    b. Perform patient assessment and preparation before the procedure; consider any special needs regarding age, physical condition, or type of fluid being infused. Explain the insertion procedure to the patient, and answer any questions the patient and/or significant others may have.
        1. Older patients have fragile veins and less SC support tissue because of thinning of the skin (Weinstein, "Intravenous therapy," 2001).
        2. Use minimal tourniquet pressure over clothing or no tourniquet with older adults. Venous distention may take longer because of slower venous return.
        3. Approach the skin with the catheter almost parallel for insertion (Weinstein, "Anatomy and physiology," 2001, "Principles and use," 2001; Whitson, 1996).

c. Interventions to reduce the pain of IV insertion should be considered, especially if they increase the chance of success (Moureau & Zonderman, 2000). Interventions include topical anesthetics, injections, and nonpharmacologic techniques.
    1. Physician order or an order from an individual with prescriptive authority is needed for any pharmacologic interventions.
    2. Topical anesthetics include creams, patches, gels, and sprays (Moureau & Zonderman, 2000).
        a. A meta-analysis of 20 studies found that EMLA® (lidocaine 2.5% and prilocaine 2.5%) cream (Astra Pharmaceuticals, LP, Wayne, PA) and ELA-Max® (Ferndale Labs, Ferndale, MI) significantly decreases pain from venipuncture and IV insertion in 85% of both pediatric and adult patients (Fetzer, 2002). Other topical creams are being tested (Browne et al., 1999).
        b. Numby Stuff® (IOMED Clinical Systems, Salt Lake City, UT) is a topical, noninvasive delivery system with results found to be superior to other agents (Miller et al., 2001; Moureau & Zonderman, 2000; Squire, Kirchhoff, & Hissong, 2000).
            i. Apply topical anesthetic according to directions (e.g., EMLA cream: apply 2.5 g to 4 x 4 cm area for puncture, cover with semipermeable transparent dressing for one hour, wipe off, and cleanse site as usual) (Weinstein, "Intravenous therapy," 2001).
            ii. Cream may cause hypersensitivity, inadvertent systemic absorption after prolonged application, and erythema at site. Anesthetic also may obscure the vein, and vasoconstriction and vasospasm have been associated with topical application (Bahruth, 1996).
        c. Ethyl chloride spray is a topical anesthetic skin refrigerant causing numbness and lasting only seconds (Moureau & Zonderman, 2000). It may cause frostbite or skin ulceration as well as being very flammable (Weinstein, "Intravenous therapy," 2001).
    3. Intradermal lidocaine injection has been found to be effective (Brown & Larson, 1999), although it may cause erythema at site, inadvertent intravascular injection, pain with injection, or hypersensitivity (Weinstein, "Intravenous therapy," 2001). One study found that it did not diminish the success rate of cannulation (Holdgate & Wong, 1999).
    4. One study found that the use of ice did not decrease pain on insertion (Richman et al., 1999); intradermal saline has mixed results, with no decrease in pain in one study (Jacobson, 1999) or results similar to intradermal lidocaine (McNelis, 1998).
    5. Using music as a distraction was found to reduce the pain associated with insertion (Jacobson, 1999). Other complementary therapy methods, such as acupuncture and hypnosis, also have been suggested (Moreau & Zonderman, 2000).

d. Wash hands: Good hand hygiene and standard precautions are used for insertion and IV maintenance; a new pair of disposable nonsterile gloves may be used in conjunction with a "no-touch" technique for peripheral IV insertion. With "no-touch" technique, the planned IV insertion site is not palpated after skin cleansing, unless sterile gloves are worn. Wash hands before and after IV catheter insertion and dressing change (O'Grady et al., 2002).
e. Organize equipment (see Appendix 2, page 120, in the original guideline document for clinical practicum).
    1. Prepare IV fluid, attach administration set, and purge if peripheral IV is to be connected to continuous fluids.
    2. If using peripheral IV for bolus medication administration, prepare IV medication and check for accuracy.
    3. If using peripheral IV as a saline lock, obtain protective cap and normal saline flush.

f. Examine veins on both extremities by visual inspection and palpation, keeping in mind the purpose of the IV therapy and any physical limitations of the patient, such as stroke-limiting use of arm or side of an axillary node dissection. Assess distal veins, then move proximally.
g. Place tourniquet 5-6 inches above insertion site. Tourniquet should obstruct the venous flow, not the arterial flow. Check presence of distal pulse, and if not felt, loosen tourniquet.
    1. Select site (Masoorli, 1997).
    2. Remove tourniquet for patient's comfort.
    3. If large amounts of body hair are present at the insertion site, clip the area. Avoid shaving, which can increase irritation and risk of infection.

h. Select appropriate IV needle or catheter.
i. Cleanse site and allow it to dry before inserting catheter. Agents for skin antisepsis include, in preferred order, 2% chlorhexidine gluconate (CHG) or 0.5% CHG in 70% isopropyl alcohol, 10% povidone-iodine, or 70% alcohol (O'Grady et al., 2002). Do not apply alcohol after povidone-iodine because alcohol negates the effect of povidone-iodine (INS, 2000). Do not use acetone or ether to cleanse skin because these agents are not effective skin cleansers and have a drying effect (LeBlanc & Cobbett, 2000).
j. Reapply tourniquet and put on disposable gloves.
k. Perform venipuncture. Insert needle at 15-degree to 30-degree angle with bevel up distal to actual site of venipuncture.
l. Look for blood return through tubing of butterfly needle or catheter, which indicates that needle has entered the vein. Butterfly needle may be taped in place at this time or threaded into the vein. An IV catheter should be threaded in its entirety into the vein and the stylet removed.
m. Release tourniquet and attach catheter to infusion set or syringe.
n. Flush the catheter free of blood while holding the IV catheter or needle in place. Watch insertion site during initial flush to assess the integrity of the vein. Edema and/or pain/discomfort at the site indicates an infiltration or ruptured vein. If this occurs, the IV will need to be removed and restarted elsewhere.

1. If the IV must be restarted, use the other extremity or select a site proximal to the previous venipuncture.
2. When administering a vesicant chemotherapy agent, select a site on the opposite extremity, if at all possible.

o. Secure IV catheter or needle with tape or an immobilization device and apply occlusive dressing over insertion site. Do not put tape directly over the insertion site.
    1. Use of transparent, semipermeable dressings is recommended and results in significantly fewer dislodged catheters, with a trend toward reduced phlebitis and infiltration than with gauze dressings (Palmer, 1998; Tripepi-Bova, Woods, & Loach, 1997).
    2. StatLock® (Venetec International, Mission Viejo, CA), a securement device, significantly reduced dislodgment episodes and increased dwell times up to 3.95 days (Sheppard et al., 1999; Wood, 1997). Other securement devices are available (Weinstein, "Intravenous therapy," 2001).
    3. For extremely short dwell times, less than 30 minutes during a procedure, micropore tape could be used, but it should be clean and not in contact with the insertion site (Campbell & Carrington, 1999).

p. No more than two attempts at cannulation per nurse per patient should be done to avoid unnecessary trauma to the patient (Fischer, Knob, & Durivage, 1997; INS, 2000).
q. Document number of attempts, locations, dressing type, securement, and patient's response after procedure is completed.

5. Removal technique
    a. Verify order for removal and indication.
    b. Note length of catheter on insertion.
    c. Explain procedure to patient.
    d. Place patient in chair or bed to stabilize extremity.
    e. Inspect general condition of catheter pathway.
    f. Discontinue all infusions into device.
    g. Put on gloves; remove dressing; and observe site for any pain, edema, redness, or discharge.
    h. Change gloves; pull catheter out in the same angle of insertion while stabilizing the skin and vein with a sterile gauze.
    i. If removal of catheter is indicated for infection, send catheter tip for culture (INS, 2000).
    j. Apply constant, firm pressure to exit site until bleeding stops (longer in patients with coagulopathies or on anticoagulants). Apply dressing or adhesive bandage, and monitor as necessary.
    k. Instruct patient/caregiver to report any discomfort or signs of bleeding, bruising, redness, swelling, or drainage.
    l. Inspect device for appropriate length and for defects. Report any defects to the manufacturer and regulatory agencies. Examine distal tip for signs of jagged, uneven edges, suggestive of breakage.
    m. Document observations and actions.

6. Maintenance and care ("ASHP therapeutic position statement," 1994; O'Grady et al., 2002; Goode et al., 1991, 1993; INS, 2000; Peterson & Kirchhoff, 1991; Randolph et al., 1998) (see Section II-A, page 3, for an overview and Table 2 in the original guideline document for Common Maintenance Procedures.)
    a. Inspect catheter insertion site and palpate for tenderness daily through the intact dressing (O'Grady et al., 2002; INS, 2000).
    b. All catheters inserted under emergency conditions are replaced within 48 hours when adherence to aseptic technique cannot be ensured (O'Grady et al., 2002).
    c. Routine replacement of catheters: The old catheter is removed and a new catheter is placed in another site.
        1. Replacement of peripheral IV catheters every 72-96 hours is strongly recommended to prevent phlebitis and catheter-related infections, as well as patient discomfort. This recommendation is based on experimental, clinical, or epidemiologic studies with a strong theoretical rationale (O'Grady et al., 2002).
        2. Although it has been reported that the incidence of thrombophlebitis and bacterial colonization of catheters increases when catheters are left in place more than 72 hours (O'Grady et al., 2002), several studies have shown no difference in complication rates with extended dwell times.
            a. In a study of the use of 665 catheters in 451 patients, the rate of phlebitis was 19.7% without a demonstrated increased risk for catheters remaining in place after three days (Bregenzer et al., 1998).
            b. In a study of 722 patients, restarting the IV after 72 hours did not reduce the risk of complications when compared to continuing the original catheter (Homer & Holmes, 1998).
            c. No difference in phlebitis rates was shown for dwell times of 72 hours versus 96 hours in a study involving 2,503 catheters (3.3% and 2.6%, respectively) (Lai, 1998).
            d. When 34 catheters were left in place over 72 hours (73-120 hours), no phlebitis was detected (White, 2001).

    d. Routine replacement of administration sets (Weinstein, "Principles and use," 2001)
        1. Replace IV administration sets every 96 hours or with catheter change, except for fluids that enhance microbial growth (i.e., blood products, lipids, total parenteral nutrition (TPN), which should be changed daily); this practice is strongly recommended unless catheter-related infection is suspected (O'Grady et al., 2002; Lai, 1998).
        2. IV administration sets changed at three days versus four to seven days in 428 low-risk patients (i.e., those not receiving total parenteral nutrition, blood products, or interleukin-2) had no difference in colonization rates (0.4% versus 0.5%) or catheter- or infusion-related bloodstream infections (Raad et al., 2001).

3. The only study found to address neutropenic patients reported no difference between IV administration sets changed at 48 versus 24 hours in terms of incidence of colonization or infusion-related septicemia (deMoissac & Jensen, 1998).
4. Tubing used to administer blood, blood products, lipids, or total parenteral nutrition is replaced every 24 hours after initiation of therapy (O'Grady et al., 2002).

7. Complications (See the "Potential Harms" field for a summary of complications or the original guideline document for full details.)

SC Infusion Devices

1. Description of SC infusion therapy and types of devices (See the original guideline document for full details.)
2. Advantages and disadvantages of SC infusions (see Table 6 in the original guideline document for full details)
3. Patient selection
    a. Patient age: Generally not restrictive
    b. Indications for SC infusion
        1. When an oral or transdermal route is inappropriate or ineffective (e.g., bowel obstruction, intractable nausea and/or vomiting, dysphagia, malabsorption, inadequate oral fluid intake secondary to confusion or infection in the elderly) (Brown & Worobec, 2000; Coyle & Adelhardt, 1996; Pasero, 2002)
        2. If the patient has poor peripheral veins (e.g., obese, elderly, or very young patients, those whose veins have been overused)
        3. When a single-lumen, long-term vascular access device is being used for other incompatible IV therapy
        4. For patients with delirium, confusion, stupor, or other mental status changes for which oral administration is contraindicated because of aspiration risk (Agency for Health Care Policy and Research (AHCPR), 1994)

    c. Purpose of the SC infusion
        1. Pain management
            a. For acute pain management when vascular access is difficult (e.g., patients with sickle cell disease who are in pain crisis) (American Pain Society, 1999)
            b. For chronic pain management when oral or transdermal route is not available, transdermal route is not tolerated, and there are no other indications for IV therapy
            c. Short-term, self-limiting SC infusion system with a local anesthetic directly into the incision site for operative and postoperative pain (available but beyond the scope of these guidelines) (Pasero, 2000)
        2. Reduction or alleviation of intractable nausea and vomiting
        3. Hypercalcemia treatment
        4. Iron chelation: For iron removal from transfusional iron overload

5. Fluid replacement (hypodermoclysis): For short-term, reversible fluid deficits when fluid replacement is not an emergency and is less than 3,000 ml/24 hours (Brown & Worobec, 2000)

4. Contraindications (See the "Contraindications" field for a summary of contraindications or the original guideline document for full details.)
5. Patient setting
    a. Patients may receive SC infusions in any setting—acute care, home care, long-term care, intermediate care, or hospice (Herndon & Fike, 2001; Smeets, Beusmans, & Weber, 1999).
    b. SC infusions are particularly well suited for non-acute care sites because of the ease of maintenance and restarts, low probability of systemic complications, reduced pain on insertion, and decreased number of injections required.

6. Insertion procedure (see Appendix 3, page 121 in the original guideline document, for clinical practicum)
    a. Infusion sites include anterior chest wall, upper abdomen, anterior or lateral aspects of thighs, above the scapula on the back, and outer upper arm.
        1. For ambulatory patients, the upper chest area (subclavicular area) is recommended because it allows full range of movement (Coyle & Adelhardt, 1996).
        2. The upper abdomen is best for patients with little peripheral SC tissue (Perry & Potter, "Intravenous and vascular access," 2002). One recommendation was made for sole use of the abdomen because a pneumothorax occurred from needle migration when the anterior chest wall was used in cachectic patients (Sheard, 1997).
        3. Locate access site away from bony prominence and patient's waistline (INS, 2000).
        4. Rotate sites when changing needle, although it may remain in the same region.

    b. Procedure
        1. Explain purpose of infusion, rationale for type of infusion, and procedure to patient and family/significant others.
        2. Select site.
        3. Prep site with cleansing agent, using circular motion and working from center out. Excess solution may be removed with sterile gauze. Allow to dry.
        4. Use smallest gauge needle/catheter available (e.g., 25 or 27 gauge).
        5. Attach tubing and infusion bag with fluids or medication; prime set. A secondary bag of normal saline is not needed because this infusion does not directly enter the vascular system.
        6. Put on gloves. Stabilize tissue with free hand, holding hand flat in a natural position, or pinch skin slightly. Local anesthetic may be used (see page 26 in the original guideline document).
        7. Insert needle with bevel down at about a 20-degree to 30-degree angle almost up to hub.

a. Other authors have recommended a 30-degree to 45-degree insertion angle (Coyle & Adelhardt, 1996; Obenour, 1998; Pasero, 2002).
b. The angle of the needle is dependent on the amount of fatty tissue and SC tissue available and whether the tissue is held flat or pinched. When minimal SC tissue is available, the smaller angle is recommended to ensure correct placement.
c. When the needle is beveled, it is placed bevel down so the fluid is infused into the SC tissue and to promote absorption.

8. Secure wings or hub with tape.
9. Check for blood return (i.e., lower unclamped solution bag or pull back on syringe). There should be no blood return, although an air bubble may be seen.
    a. If blood is seen in tubing, clamp tubing and remove needle.
    b. Repeat procedure using new needle and an adjacent site.
    c. If no blood is seen, clamp tubing.
10. Attach tubing to pump, set correct rate, unclamp tubing, and turn pump on.
11. Cover with semipermeable, transparent dressing. Secure tubing to either dressing or skin.

7. Maintenance
    1. Observe site every eight hours for local irritation or leakage, and assess patient's comfort with infusion placement and infusion rate (Obenour, 1998).
    2. Recommendations for catheter or needle replacement vary. Catheters and needles may be replaced every three days (INS, 2000); every five days (Smeets, Beusmans, & Weber, 1999); weekly (Coyle & Adelhardt, 1996; Obenour, 1998); if bruising, erythema, or other signs of local irritation or infection appear; or if the site is painful to the patient.
    3. Transparent dressings may be left in place for up to a week and changed with insertion of a new catheter or needle (O'Grady et al., 2002).
    4. Clients, families and significant others, and assistive personnel should be instructed to report any leakage, erythema, edema, or pain at injection site as soon as possible.

8. Removal
    a. Verify order or indication for removal.
    b. Explain procedure to patient.
    c. Place patient in chair or bed for stabilization.
    d. Discontinue all infusions.
    e. Put on gloves, remove dressing, and observe site for edema, erythema, or discharge. Remove gloves and replace.
    f. Pull catheter/needle out in the same angle as insertion while stabilizing the skin with a sterile gauze.

g. Apply constant firm pressure to exit site if there is bleeding. Apply small bandage.
h. Instruct patient/caregiver to report any discomfort or signs of bleeding, bruising, erythema, edema, or drainage.
i. Document observations and actions.

9. Administration of medications and fluids
    a. Medications and fluids should be isotonic, nonirritating, nonviscous, and water soluble (Perry & Potter, "Parenteral medications," 2002).
    b. Medications
        1. Any analgesic available for parenteral use is acceptable for SC infusion except meperidine hydrochloride, which causes tissue necrosis (DHHS, 1994).
            a. Morphine or hydromorphone are the preferred analgesics for home administration (DHHS, 1994).
            b. Hydromorphone is recommended as the most cost-effective analgesic because it is very potent and high doses can be delivered in small amounts. Stability was found to be 28 days (Fudin et al., 2000). Hydromorphone is at least as effective as morphine using the SC infusion route (Miller et al., 1999).
            c. Morphine was found to be equianalgesic for IV and SC routes when administered as a continuous infusion (Nelson et al., 1997). In normal circumstances, morphine is measured in the plasma within 15 minutes of SC injection, and peak concentration occurs at 30 minutes. Pasero (2002) recommended an equivalency ratio of 3:1 when converting from oral morphine to SC morphine.
            d. Other commonly used opioids include oxymorphone, levorphanol (Coyle & Adelhardt, 1996), methadone, and fentanyl (Polomano, McGuire, & Sheidler, 2000; Watanabe et al., 1998).
            e. Methadone does cause skin irritation with infusion (erythema and induration), but several authors have proposed successful interventions. These include the use of dexamethasone in the infusion (Mathew & Storey, 1999), the use of hyaluronidase in the infusion, and site rotation every 24 hours (Makin, 2000). Currently, hyaluronidase is not available from the manufacturer.
            f. The IV opioid dose is considered clinically equivalent for SC use (Coyle & Adelhardt, 1996; DHHS, 1994).
            g. The PCA mode allows for rapid individual dose titration and provides sense of control for the patient. This can be done both in the hospital and in the home (DHHS, 1994).
            h. Ketamine also has been used for cancer pain (Bell, 1999; Fine, 1999; Lloyd-Williams, 2000).

        2. Other symptom management

a. Octreotide, scopolamine, and phenobarbital have been used for symptom management (Ripamonti et al., 2000; Stirling, Kurowska, & Tookman, 1999).
b. Metoclopramide has been used for intractable nausea and vomiting in SC infusions (Bruera et al., 1996).
c. Hypercalcemia may be treated with SC infusion of clodronate (Body, 2000).
d. Drugs used for iron overload include deferoxamine and deferiprone (Kontoghiorghes et al., 2000).

c. Fluids
1. Solutions include 0.9% sodium chloride or a mixture of 0.9% sodium chloride and 5% dextrose; dextrose alone cannot be used because although it is isotonic, in the body it becomes hypotonic because of rapid metabolism (Brown & Worobec, 2000). Potassium has been added without local irritation (Steiner & Bruera, 1998).
2. The use of the enzyme hyaluronidase has been debated because of its effectiveness and potential systemic reaction. It facilitates fluid absorption from the tissue, especially when the fluid is infused rapidly or in large quantities. When used, the dose ranges from 150 units to 600 units per 1,000 ml of infusate; it only is used when absorption is poor (Brown & Worobec, 2000; Centeno & Bruera, 1999; Ferry, Dardaine, & Constans, 1999). It may cause a systemic reaction, so a test dose may be considered. Currently, hyaluronidase is not available from the manufacturer.
3. Fluid replacement using SC infusion has been shown to be as effective as IV therapy with decreased cost and a trend toward fewer fluid therapy-related complications (Dasgupta, Binns, & Rochon, 2000).

d. Rate of infusions
1. Recommended maximum infusion rate for medications is 3 ml/hour (INS, 2000). Researchers in one study used 5–7 ml/hour with minimum skin irritation (Nelson et al., 1997). Faster infusion rates result in tissue irritation and sloughing unless other measures are taken, such as using hyaluronidase in the infusate.
2. Concentrate the drug dose to ensure maximum flow rate of 3-5 ml/hour or less, taking bolus dosing into consideration (Wall & Melzack, 1999).
3. Rates for fluid replacement depend on how quickly the replacement must be achieved but range from 20-80 ml/hour and can safely be as high as 300 ml/hour (Brown & Worobec, 2000; Centeno & Bruera, 1999; Dasgupta et al., 2000). Fluid replacement for some patients has been done at night only (Dasgupta et al., 2000).
4. An electronic infusion device should be used to deliver the infusion (INS, 2000). Several portable electric and nonelectric infusion devices were compared and showed similar reliability of infusion rates (Capes, Martin, & Underwood, 1997).

Examples include electronic syringe driver, and elastomeric, balloon, or peristaltic pumps.

2. Complications (See the "Potential Harms" field in this summary for a summary of potential harms or the original guideline document for full details.)

Midline Catheters

1. Description and types (See the original guideline document for full details.)
2. Advantages and disadvantages (see Table 6 in the original guideline document for full details)
3. Patient selection criteria
    a. Patients with limited peripheral veins for venous access
    b. Patients with need for venous access for a limited length of time (several weeks)
    c. Patient or caregiver is willing and able to understand and follow instructions on how to properly care for the device in the home setting.
    d. Intravenous therapy planned appropriate for midline catheter. Contraindicated intravenous fluids include
        1. Continuous infusion of vesicants
        2. Solutions with glucose concentration >10%
        3. Solutions with protein concentration >5%

    e. Patient preference for this type of device over more permanent devices
    f. Life expectancy of patient
    g. For patients scheduled to receive IV therapy for more than a week, a plan should be followed to maximize comfort and preserve the integrity of the veins.
    h. Inappropriate patients include patients with lymphedema of the arm or those who will need to do heavy lifting with the arm used (Greene, 2000).

4. Insertion technique
    a. Insert in an antecubital vein terminating in the upper arm or axilla (see Figures 1 and 2 in the original guideline document). Appropriate veins include
        3. Basilic
        4. Cephalic
        5. Median cubital

    b. Determine if the patient is a suitable candidate for a midline catheter based on patient selection criteria and patient willingness to care for and protect a catheter.
    c. Explain the procedure to the patient and answer any questions the patient and/or significant others may have.
    d. Organize equipment and wash hands.
    e. Examine veins on both extremities, taking into account the purpose of the IV therapy, the most comfortable exit site for the patient, and any physical limitations the patient may have, such as stroke or lymphedema, that could limit the use of one arm.

f. Use a measuring tape to determine the proper length from the insertion site to the axilla.
g. Use local anesthetic (topical, injectable) per institutional policy and patient preference. Be aware that anesthetic may obscure the vein secondary to vasoconstriction and vasospasm. An order from a healthcare provider with prescriptive authority is needed (see page 26 in the original guideline document).
h. Place the line, per manufacturer's guidelines, for the type of catheter being used; the nurse inserting should be trained for the individual product. Prior to insertion, the line should be cut based on the measurement from the insertion site to the axilla. Insertion techniques include the following.
    1. Through the peel-away sheath
    2. Over-the-wire method
    3. Modified Seldinger technique
    4. Through the peel-away needle
    5. Catheter pre-inserted through a peelaway needle

i. Place tourniquet five to six inches above insertion site. Tourniquet should obstruct venous, not arterial flow. Check presence of distal pulse.
j. Clip the area if a large amount of body hair is present at insertion site. Avoid shaving, which can cause increased irritation and risk of infection. Remove tourniquet for patient's comfort.
k. Cleanse site and allow to dry. Reapply tourniquet. Apply gloves.
l. Perform venipuncture by inserting needle at a 15-degree to 30-degree angle with bevel up distal to actual venipuncture site.
m. Look for blood return through tubing of catheter, which indicates that the needle has entered the vein. Advance to length of needle and remove tourniquet.
n. Once venipuncture is complete, retract the needle into the needle safety tube on the external end of the catheter. The tip of the catheter is advanced for several inches to the proximal end of the upper extremity, with the tip located just short of the axilla (Larouere, 2000).
o. Secure IV catheter with tape and apply dressing over insertion site.
p. The dressing should be changed 24 hours after insertion to assess for complications, then as per protocol for transparent film or gauze dressing.
q. As a midline catheter is not considered a central catheter, x-ray verification of tip placement is not indicated.
r. Document insertion, including type of line used and length of catheter.

5. Removal technique
    a. Verify order for removal and indication.
    b. Explain the procedure to the patient and answer questions.
    c. Place the patient in a reclining position.
    d. Inspect the general condition of the catheter.
    e. Discontinue all infusions into the device.
    f. Put on gloves, remove dressing, and observe site for redness, swelling, bruising, or drainage.
    g. If drainage is present, send swabs for culture.

h. Change gloves.
i. Grasping device by hub, pull slowly and steadily until completely removed.
j. If infection is suspected, send catheter tip for culture.
k. Apply constant firm pressure to the exit site until the bleeding has stopped (longer in patients with coagulopathies or decreased platelet count). Apply sterile occlusive dressing and monitor for bleeding or drainage.
l. Measure catheter for appropriate length and catheter integrity. Examine distal tip for jagged edges that would suggest breakage. If found, report to physician.
m. Document length of catheter on removal, action, and patient response.

6. Maintenance and care (see Section II, B-6, page 28 in the original guideline document for full details)
7. Complications (See the "Potential Harms" field for a summary of complications or the original guideline document for full details.)

Peripherally Inserted Central Catheters (PICC)

1. Description and types (See the original guideline document for full details.)
2. Catheter tip location
    a. Appropriate tip location of a PICC is the distal third of the superior vena cava (Hadaway, 1999).
    b. A catheter that is trimmed so the tip falls in the axillary or subclavicular junction is termed midclavicular (midline catheter) and should be used only for drugs safely administered via peripheral veins (Macklin, 1997).

3. Patient selection criteria (Hadaway, 1990; Merrell et al., 1994)
    a. Patients without accessible peripheral vessels or with a minimal number of adequate vessels available for use in the administration of therapy for moderate duration (less than six months)
    b. Patients who are in need of the infusion of vesicant or irritating medications
    c. Patients who are in need of hyperosmolar solution, such as total parenteral nutrition
    d. Patient preference for this type of device or other vascular access devices, which may be equally appropriate for the situation
    e. In the home setting, availability of family member/significant other who can properly care for the device
    f. For patients scheduled to receive IV therapy for more than five days, a plan should be followed to maximize comfort and preserve the integrity of the veins.

4. Advantages and disadvantages (see Table 6 in the original guideline document for full details)
5. Insertion techniques (Goodwin & Carlson, 1993; James, Bledsoe, & Hadaway, 1993; La Fortune, 1993)
    a. Insert PICCs via the vein (Ryder, 1993) (see Figure 3 in the original guideline document).
        1. Cephalic

2. Accessory cephalic
3. Basilic
4. Median cubital

b. Perform a preplacement assessment of the patient to determine if a PICC is appropriate.
c. Choose appropriate PICC size (diameter) for solution to be administered. Use the smallest acceptable catheter diameter to decrease incidence of thrombophlebitis (Grove & Pevec, 2000).
d. Explain the insertion procedure to the patient and answer any questions the patient and/or significant other may have. Ensure that informed consent is obtained.
e. Gather all necessary supplies, including any IV administration set and medications/IV fluids to be used.
f. Wash hands with a cleansing agent.
g. Examine arms and select the best vein for cannulation.
    1. Avoid veins that are sclerotic on inspection and palpation.
    2. Select patient's nondominant arm, if possible.
    3. Avoid extremities that may have compromised circulation, such as the presence of lymphedema or venous congestion secondary to superior vena cava syndrome.
    4. If possible, the basilic vein would be the best choice, as it is the straightest and has the most direct route to the central venous system (Timmis, 1998).
    5. The cephalic vein is the second choice because its abrupt angle that joins to the axillary vein makes the advancement of the line more difficult. Position the arm at a right angle to the body to assist with insertion (Timmis, 1998).

h. Consider the use of a local anesthetic (topical cream or intradermal injection) to reduce the pain associated with insertion (Ahrens, Wiersema, & Weilitz, 1991; Harrison, Langham, & Bogod, 1992; Kano et al., 1992).
    1. An order is needed from a healthcare provider with prescriptive authority.
    2. Apply topical anesthetic according to directions (see page 26 in the original guideline document) (Joyce, 1993; McPhail, 1992; Smith et al., 1990; Steward, 1993).
    3. Cream may cause hypersensitivity, inadvertent systemic absorption after prolonged application, and erythema at the site.
    4. Intradermal injection may cause erythema at site, inadvertent intravascular injection, pain with injection, or hypersensitivity.
    5. Anesthetic may obscure the vein. Reports of vasoconstriction and vasospasm have been associated with topical application (Bahruth, 1996).

i. Use a measuring tape to determine appropriate catheter length by measuring from the point of venipuncture, over the course of the selected venous pathway, across the shoulder to the right side of the sternal notch, and down to the third intercostal space. The tip of the catheter should rest in the superior vena cava (see Figure 3 in the

original guideline document). Add 2.5 cm (1 inch) onto this measurement to account for the length of the catheter outside of the insertion site.

j. Open the chosen PICC tray and, following sterile technique, add additional supplies. The general insertion procedure may vary according to the type of PICC being used. The RN needs to be familiar with the product selected and to follow manufacturer's directions.
k. Position the patient's arm at a 45-degree to 90-degree angle from the body, below heart level, to aid in vein engorgement.
l. Perform catheterization with full aseptic technique, including surgical hand scrub, mask, sterile gown, gloves, drapes, and appropriate cleansing agents (INS, 2000; Masoorli & Angeles, 1990; Timmis, 1998).
m. Place sterile waterproof drape under patient's arm.
n. Cleanse the area, and allow the area to air dry before initiating cannulation.
o. Fill two syringes with normal saline. Use one syringe to prime extension tubing that may be needed during the procedure.
p. Place fenestrated sterile drape (a sterile drape with an opened center) over the arm, leaving the insertion site exposed.
q. Prepare the catheter.
    1. Measure the length of catheter needed, using the sterile measuring tape.
    2. Pull the guidewire back ½ inch from this distance.
    3. Trim the catheter with sterile scissors according to the manufacturer's recommendation. Some PICC manufacturers do not recommend trimming the catheter. Others recommend trimming at a 45-degree or 90-degree angle. Groshong PICCs are trimmed proximal and not at the distal tip.

r. Apply tourniquet approximately four inches above selected site. Check distal pulse to ensure that arterial circulation has not been compromised. Change sterile gloves.
s. While stabilizing the vein, perform venipuncture. Note blood return, which indicates introducer location inside vein.
t. Release tourniquet and continue to advance the catheter according to the PICC insertion technique used (Goodwin & Carlson, 1993; Hadaway, 1995; Loughran & Borzatta, 1995).
    1. Breakaway needle technique: Venipuncture is made with a specially designed split introducer needle. After needle insertion, the catheter is threaded into place. The introducer needle is removed and slid down to the catheter hub. The needle is broken apart and peeled away from the catheter.
        a. Advantages: Uses familiar and simple needle insertion, requires insertion of only one device, and is available in a variety of gauge sizes.
        b. Disadvantages: The potential exists for catheter damage and embolus if catheter is inadvertently drawn back through the introducer needle; the steel introducer needle may cause vascular damage; and a slight increase in blood spillage occurs.
    2. Through the intact cannula technique: Venipuncture is made with a short-term peripheral introducer cannula with a stylet.

The stylet is removed, and the catheter is threaded into the vein. The short catheter is removed by pulling it over the external end of the PICC.

   a. Advantages: Risk of catheter damage is greatly reduced; it entails a familiar initial venipuncture technique; minimal blood loss occurs; and trimming of catheter is done on the external portion.
   b. Disadvantages: It is a slightly more complicated procedure; careful monitoring of the length of the catheter is required because the catheter is trimmed after insertion; and a larger introducer unit is needed for venipuncture. Only used for catheters with unattached hubs (e.g., Groshong).

3. Peel-away sheath technique: Venipuncture is made with a needle/sheath device. After the stylet is removed, the catheter is threaded into the vein, and the sheath/cannula is removed down to the hub of the catheter. Wings of the sheath/cannula are cracked, and the two sections are pulled apart and away.
   a. Advantages: Risk of catheter damage is low; a variety of gauge sizes is available; and it can be performed virtually without blood spills.
   b. Disadvantages: A larger introducer unit is required, as is the acquisition of a new skill (peeling away a sheath). It may cause more bleeding around exit site during first few hours after insertion.
4. Over-wire Seldinger method: Venipuncture is made with a smaller gauge steel needle. Blood is obtained in the attached syringe. The syringe is removed, and a guidewire is threaded through the needle into the vein. The needle and cannula are removed, and a peel-away sheath is threaded down to the skin over the guidewire introducer. The guidewire is removed and the catheter is advanced, stabilized, and the sheath removed and torn away.
   a. Advantages: Requires smaller venipuncture; a variety of gauge sizes is available; and the risk of catheter damage is eliminated.
   b. Disadvantages: It is a more complex technique; the need for a minor surgical incision may limit its insertion in particular settings and by certain clinicians; and insertion costs more than other methods.

u. Attach prefilled syringe and flush with normal saline. Ensure adequate blood return. A primed extension tubing may be attached at this time.
v. After securing the catheter with tape, SteriStrips, or StatLock, flush with heparin solution (Andersen & Holland, 1992).
w. Some PICCs may be best secured into place with sutures. Refer to the State Board of Nursing Practice Act regarding the insertion of sutures by an RN.
x. Apply dry, sterile gauze above insertion site and place an occlusive dressing over the insertion site and external part of the catheter up to the hub. Change dressing 24 hours after initial insertion (likely to have bloody drainage), and apply only a transparent dressing (Sansivero,

1997; Timmis, 1998). Several manufacturers have developed PICC line securing devices (Macklin, 1997).

y. Radiographic confirmation must be performed to ensure correct placement.

6. Removal technique (Macklin, 2000)
    a. Verify order for removal of catheter.
    b. Gather materials you will need: measuring tape, alcohol pad, gauze, and tape.
    c. Wash hands and don nonsterile gloves.
    d. Remove existing dressing. Remove contaminated gloves and replace gloves.
    e. Grasp PICC at the insertion site and slowly pull outward, about one inch, pulling parallel to the skin.
    f. Release it and grasp again at insertion site, continuing to pull the PICC out in short increments.
    g. When PICC is completely removed, place gauze over the site and apply light pressure until bleeding stops, then apply tape.
    h. Observe catheter tip for integrity, and measure length and compare it to the length documented at insertion.
    i. Problems with removal (Macklin, 2000)
        1. Venospasm
            a. If you sense resistance during removal, stop. Reposition the arm and attempt to remove it again.
            b. If resistance continues, apply warm compress to upper arm for 15-20 minutes and attempt gentle removal again.
            c. If the catheter has been removed far enough so that you can apply a tourniquet above the area containing the catheter, apply the tourniquet to the arm, and attempt removal again.
            d. If resistance is still present, apply dressing to insertion site and leave alone for 12-24 hours and attempt removal again.

        2. Thrombosis
            a. Will cause the PICC to eventually lodge in the lumen of the vessel as you attempt removal
            b. If during removal you are only able to pull the PICC out four inches or less, stop.
            c. Because you do not know whether this is caused by venospasm or thrombosis, use interventions recommended for venospasm.
            d. If these attempts fail, notify physician for possible radiologic studies, to rule out thrombus.

        3. Catheter fracture
            a. Catheters already may be damaged prior to removal or may become damaged if excessive force is applied during the removal process.

b. If the catheter breaks during removal but is still long enough to be pulled, clamp the catheter and continue removal.
c. If the catheter breaks at the insertion site, clamp it and apply a tourniquet around the upper arm in an attempt to prevent migration of the fragment. The tourniquet should not impede the arterial flow; check radial pulse.
d. Notify the physician immediately, as a cutdown procedure will be needed to extract the catheter.
e. If a complete fracture occurs within the vein above the insertion site, immediately apply the tourniquet at the highest point on the arm.
f. The fragment can become an embolus. Observe for shortness of breath, tachycardia, confusion, pallor, or hypotension. Place patient in Trendelenburg position, and contact the physician immediately. The fragment will need to be removed by an interventional radiologist, thoracic surgeon, or vascular surgeon.

7. Maintenance and care (see Section II, A-4, page 5, on vascular access devices and Tables 2 and 3 in the original guideline document)
8. Complications (See the "Potential Harms" field for a summary of complications or Section II, A-6, page 12, on vascular access devices and Tables 4 and 5 in the original guideline document for full details.)

Central Venous Lines (Nontunneled)

1. Description and types (See the original guideline document for full details.)
2. Insertion of catheters with a percutaneous technique using a guidewire or stylet.
3. Advantages and disadvantages (see Table 6 in the original guideline document for full details)
4. Patient selection criteria
    a. Size of patient/vein may determine the gauge of catheter and the number of lumens used. Smaller catheters decrease the incidence of venous thrombosis (Dooley et al., 1995). Adequate venous flow around the catheter also ensures appropriate dilution of medications (Greene, 2000).
    b. Short-term treatment (up to six weeks), with no need for extended therapy anticipated
    c. Patients with poor peripheral venous access
    d. Patient who needs frequent venous access requirements for infusion or blood specimens
    e. Poor surgical candidate for long-term catheter placement
    f. Short life expectancy
    g. Critically ill patients requiring multilumen access (Fischer, Knobf, & Durivage, 1997)
    h. When choosing the type of line for the patient, consider that infection rates rise exponentially with the addition of each subsequent lumen (Dooley et al., 1995).

5. Insertion location

a. Preferentially use the right internal jugular vein as the entry site because it follows a fairly straight course to the subclavian. A triangle of landmarks (clavicle and the two heads of the sternocleidomastoid muscle) identifies the insertion site.
b. Cannulate the subclavian vein on the left side, if possible, because it has a smooth curve to the superior vena cava without an acute turn.
c. If the right internal jugular is not available, the left internal jugular, the external jugular, or the subclavian veins may be used (Webster, 2001) (see Figure 2 in the original guideline document). In patients with chest pathology, a femoral attempt with the tip in the inferior vena cava is possible but has an increased risk of infection and other side effects, including thrombotic complications and complete venous thrombosis (Goodman, 2000; Merrer et al., 2001).

6. Insertion techniques
    a. Perform a preplacement assessment of the patient to determine if a nontunneled catheter is appropriate, based on patient selection criteria.
    b. Explain the insertion procedure to the patient and answer any questions the patient and/or significant others may have. Ensure that informed consent is obtained. Determine if the patient has allergies to iodine or tape products, and inform the practitioner placing the line.
    c. Position the patient (Dooley et al., 1995; Masoorli & Angeles, 2002).
        1. Usually, the patient is placed in a 15-degree Trendelenburg position, which distends the vein selected for venipuncture and decreases the risk of air embolism.
        2. If the internal jugular is to be used, the patient's head should be turned to the opposite side of the catheterization to decrease contamination and make the site more accessible.
        3. A rolled towel may be placed beneath the neck and shoulders to increase venous distention.

    d. Prep the insertion site with a cleansing agent. If necessary, clip (do not shave) long hair to decrease contamination.
    e. Use local anesthetic to decrease insertion discomfort.
    f. Insert needle percutaneously into the vein, using the clavicle as a guide (Masoorli & Angeles, 2002).
        1. When a flashback is observed in the syringe, the syringe is removed, and a guidewire is advanced into the vein. The guidewire should not be advanced farther than 18 cm in order to minimize complications (Andrews, Bova, & Venbrux, 2000).
        2. The catheter is advanced over the guidewire into the subclavian vein until it reaches the superior vena cava. Use of a peel-away sheath protects the catheter until it is inserted and decreases the risk of infection.
        3. The guidewire is removed.

    g. Flush each lumen with heparinized saline. Flush closed-valve lumens with saline.
    h. Suture the catheter to the skin or secure it with tape, and then apply an occlusive dressing over the exit site.

i. Obtain a chest x-ray before therapy is initiated to determine proper placement, location of the tip, and to detect pneumothorax, although there is a low incidence of complication following subclavian or nontunnelled central line placement (Burn, Skewes, & King, 2001). Tip placement in the right atrium is unacceptable, as the tip could trigger arrhythmias if it comes in contact with the sinoatrial node (Masoorli & Angeles, 2002).
j. Allow a physician, nurse practitioner, or radiologist to verify the proper position in the superior vena cava; then the line may be used immediately for infusion.
k. Document length of catheter, presence of blood return, and condition of patient.

7. Nontunneled lines are removed when therapy is completed, when the line is no longer functional because of thrombus or mechanical failures or when the line is infected.
    a. Potential complications related to central line removal include venous air embolism, dyspnea, pain, bleeding from the insertion site, and arrhythmias (Dumont, 2001).
    b. Routine replacement of a nontunneled central catheter should not be performed (O'Grady et al., 2002; Timsit, 2000).

8. Removal technique
    a. Verify order for removal and indication.
    b. Note the length of the catheter on insertion.
    c. Explain the procedure to the patient.
    d. Place patient in a reclining position.
    e. Inspect the general condition of the catheter.
    f. Discontinue all infusions into the device.
    g. Put on gloves, remove dressing, and inspect exit site for redness, pain, swelling, exudate, or other problems.
    h. Change gloves and remove sutures, if present.
    i. Have patient perform Valsalva maneuver (Masoorli & Angeles, 2002). Performing the Valsalva maneuver decreases the risk of air embolism during catheter removal. The maneuver is contraindicated in patients with increased intracranial pressure or if intubated.
        1. Instruct the patient to take a deep breath and hold it.
        2. Patient should "bear down" for 10 seconds.
        3. Patient then exhales.

    j. Grasp hub of nontunneled catheter and gently and steadily retract catheter until completely removed.
    k. Apply constant, firm pressure to the exit site until bleeding stops (longer in patients with coagulopathies or decreased platelet count). Apply sterile, occlusive dressing and monitor patient for discomfort, bleeding, bruising, redness, swelling, or drainage. Advise patient/family to report above signs.
    l. Visually inspect the VAD for appropriate length and defects, such as holes, tears, or jagged edges suggesting breakage. If length is shorter than expected or the edges appear broken, notify the physician.
    m. Document observations, actions, and patient teaching.

9. Maintenance and care (see Section II, A-4, page 5, and Tables 2 and 3 in the original guideline document for full details)
10. Complications (see the "Potential Harms" field for a summary of complications or see Section II, A-6, page 12, and Table 4 in the original guideline document)
11. Education and documentation (see Section VIII, page 80 in the original guideline document)

Tunneled Central Venous Catheters (CVCs)

1. Description and types (See the original guideline document for full details.)
2. Advantages and disadvantages (see Table 6 in the original guideline document for full details)
3. Patient selection criteria: May be used in any patient population that requires longterm IV access, such as bone marrow transplantation, hematologic disease, or malignant diseases that will result in a prolonged nadir of blood counts after therapy.
4. Insertion technique: Surgical procedure by surgeon or interventional radiologist after informed consent is obtained (Alexander, 1994)
    a. Select the vein according to the individual patient's anatomical structure, type and purpose of catheter, and the vessel used. The most common veins used for insertion include the following (see Figure 2 in the original guideline document).
        1. Subclavian vein
        2. Internal or external jugular vein
        3. Cephalic vein
        4. Femoral vein (Note: If the subclavian, cephalic, or external jugular veins are unable to be cannulated because of superior vena cava syndrome, obstruction of the subclavian vein, tumor blockage, bilateral radical neck dissection, or trauma to the upper torso, the saphenous vein can be cannulated with the catheter advanced into the inferior vena cava [Wickham, 1990].)

    b. Perform percutaneous insertion using the Seldinger method (Baranowski, 1993; Silberman, Berne, & Escandon, 1992).
        1. It is the most common insertion technique using the subclavian or internal jugular vein. Once the vein is cannulated, the guidewire is advanced into the vein.
            a. A pull-apart sheath introducer is threaded over the guidewire.
            b. The guidewire is removed, and the catheter is advanced through the introducer into the vein.
            c. The catheter is tunneled through the SC tissue. The tunnel is created from the vein entry site to the exit site. With the antegrade technique, the catheter is pulled from the exit site through the tunnel to the vein entry site and trimmed. With the retrograde technique, the catheter is pulled from the vein entry site to the exit site and trimmed.

2. The exit site depends on male and female anatomy; however, usually it is above the nipple line midway between the sternum and clavicle.

c. Perform the cut-down insertion (Hadaway, 1995).
    1. The procedure greatly reduces risk of hemothorax or pneumothorax.
    2. This technique is more time-consuming and difficult to perform than other methods.
    3. The procedure requires more manipulation of the skin and SC tissue, thereby increasing the infection rate.
    4. The veins used include the axillary, external jugular, internal jugular, cephalic, and subclavian.

d. Verify catheter position by radiographic imaging (Guth, 2001).
e. Secure catheter with sutures.
    1. Exit site sutures remain in place until healing occurs, which can range from 10 days to 6 weeks or longer if immunosuppression is present.
    2. Sutures are removed after healing to prevent irritation at the exit site.
    3. In some cases (e.g., the use of apheresis catheters), sutures are left in place until the catheter is removed because of the risk of catheter dislodgment caused by the external weight of the catheter.

5. Removal technique: RNs may be able to remove tunnel catheter, depending on their specific State Board of Nursing Practice Act.
    a. Verify order for removal and indication.
    b. Note length of catheter on insertion.
    c. Explain procedure to patient.
    d. Place patient in reclining position.
    e. Inspect general condition of catheter and tunneled pathway.
    f. Discontinue all infusions into device.
    g. Put on gloves, remove dressing, and observe site for edema, erythema, or other problems.
    h. Change gloves and remove sutures as needed.
    i. Have the patient perform Valsalva maneuver (Thielen & Nyquist, 1991). Grasp hub of VAD and gently and steadily retract catheter until completely removed.
    j. Send catheter tip for culture, if removal of VAD is indicated for infection (Hadaway, 1995; Windmer et al, 1992).
    k. Apply constant firm pressure to exit site until bleeding stops (longer in patients with coagulopathies or patients on anticoagulant therapy). Apply sterile occlusive dressing and monitor as necessary. Some institutions use triple-antibiotic gauze or petroleum jelly gauze when dressing is applied to prevent air from entering SC space.
    l. Instruct patient/caregiver to report any discomfort or signs of bleeding, bruising, erythema, edema, and drainage.
    m. Inspect device for appropriate length and for defects. Report any defects to the manufacturer and regulatory agencies. Examine distal tip for signs of jagged, uneven edges suggestive of breakage.

n. Document observations and actions.
o. Contact a physician immediately if difficulty occurs in retrieving the cuff or with removal of catheter.
p. If tunnel infection is suspected, a cutdown procedure may be performed to remove the cuff, based on physician preference.
q. If there is a question of incomplete catheter removal, call the physician immediately. A chest x-ray or cathetergram is recommended.

6. Maintenance and care (see Section II, A-4, page 5, and Tables 2 and 3 in the original guideline document)
7. Complications (see the "Potential Harms" field for a summary of complications or see Section II, A-6, page 12, and Tables 4 and 5 in the original guideline document)
8. Education and documentation (see Section VIII, page 80 in the original guideline document)

Implanted Venous Ports (see Figure 4 in the original guideline document)

1. Description and types (See the original guideline document for full details.)
2. Advantages and disadvantages (see Table 6 in the original guideline document for full details)
3. Patient selection criteria
    a. Patients who require intermittent intravenous therapy
    b. Patients who are unwilling to care for an external line
    c. Patients who are unable to care for an external line because of poor vision, poor dexterity, an inability to comprehend, or who do not have a caregiver
    d. Patients with a very active lifestyle, including swimming and outdoor activities
    e. Patients who are not extremely obese, because the port must be sutured to the muscle and under the adipose layer, making it difficult to locate and access the port septum. Also, the port can migrate further in SC tissue.
    f. Patients who find needle sticks extremely traumatic may not be good candidates for a totally implanted device.
    g. Patients with poor peripheral access and ongoing IV needs
    h. Ample chest area is required, so patients with open chest wounds, tumor involvement of the chest wall, or radiation fibrosis are poor candidates (Camp-Sorrell, 1992).
    i. Peripherally placed ports are an option in patients with chest pathology or those patients in whom obesity would make it difficult to access a chest-placed port.

4. Insertion techniques
    a. Ideally, the nurse should assist in determining the optimum location for the portal body (Goodman, 2000).
        1. The portal body should be located over a rib for stability.
        2. Placing the port over the sternum in obese patients assists in locating and accessing the port.
        3. In women, the port should not lie under a bra strap or edge, therefore the woman should be sitting and clothed when placement is determined.

4. Consider the activity level of the patient.
5. Avoid placement in the axilla, breast tissue, or soft tissue of the abdomen to avoid access problems.
6. A preferred site and an alternate site should be marked for the surgeon.
7. A peripheral port is placed below or above the antecubital fossa, to minimize range of motion impairment.

b. After obtaining consent, the patient is taken to the operating room or interventional radiology. The procedure may be performed under straight local anesthesia, a local with the addition of sedation, or general anesthesia. Insertion may be performed under fluoroscopy to facilitate correct tip placement.
c. The most common veins used include the following (see Figure 2 in the original guideline document).
    1. Subclavian
    2. Internal or external jugular
    3. Cephalic, basilic, or axillary (peripheral port)
    4. Femoral

d. The catheter is placed using the cut-down technique or the percutaneous method.
    1. Pre-attached catheters are measured and cut from the distal end.
    2. Separate catheters are inserted, and then may be cut at the proximal (portal body) end.

e. If portal body is separate, the catheter is connected per manufacturer's instructions based on the type of locking mechanism.
f. An incision is made to create a port "pocket," preferably in a previously determined location.
    1. The portal body is placed over a bony area for stabilization, under the adipose layer, and sutured to the fascia layer.
    2. The suture line should not be over the top of the port septum to maintain the integrity of the suture line (Goodman, 2000).

g. Following closure of the port pocket, the port is accessed using a noncoring needle, and the system is flushed to ensure patency and blood return.
    1. If the port is to be used immediately, the needle should be left in place and dressed occlusively, as postoperative edema and tenderness of the incision make postsurgical access more difficult.
    2. If the port is not used immediately, the needle is removed, and a dressing applied over the port pocket incision and the catheter entry site.
    3. Ideally, the port should not be accessed for several days to allow edema and tenderness to resolve. If it needs to be used sooner, instruct the patient to apply an ice pack to minimize edema.
    4. When a peripheral port is placed, that arm should not be used to obtain blood pressure and should not be used for peripheral

blood drawing or infusions of IV solutions except through the port (Sims Deltec, 2000).

h. Radiographic imaging is obtained following insertion to determine tip placement and to assess for complications of insertion.

5. Access and de-access procedures (see Appendix 6, page 125 in the original guideline document)
    a. Implanted ports must be accessed with a special noncoring needle (see Figure 4 in the original guideline document).
        1. A specially designed needle tip separates the silicone septum, preventing "coring" of the diaphragm, which could lead to debris in the reservoir and ultimate degradation of the integrity of the septum.
        2. An offset bevel allows the tip of the needle to be flush with the bottom of the reservoir without impeding the flow of solution.
        3. Noncoring needles are available in a variety of sizes and configurations.
            a. Length varies from 0.5-1.5 inches
            b. Most commonly used gauge is 19-22.
            c. Straight needles are available for flushing with immediate deaccessing or bent at a 90-degree angle for continuous infusions.
            d. Needles are available as the needle alone or attached to a short piece of tubing.
            e. The system has extension tubing with a clamp.
                i. Wings may or may not be attached to the hub for easier access and stabilization of the needle to the chest.
                ii. The extension tubing also may have a Y-site.

    b. To decrease the discomfort during needle access, the patient may be offered topical anesthetic with a physician's order (see Section II, B-4, c)-(1), page 26 in the original guideline document).
    c. When not in use, implanted ports must be accessed and flushed every 4-6 weeks to maintain patency.
    d. Positive pressure technique is extremely important in preventing the development of fibrin sheaths, leading to withdrawal or infusion occlusions and contributing to the development of venous thrombosis. The following procedures prevent the slight negative pressure on the end of the catheter that results in pulling a small amount of blood into the end of the catheter, where it becomes a fibrin sheath.
        1. Positive pressure is maintained while flushing an accessed port by clamping the port tubing while still flushing the line.
        2. Port access devices that do not have a clamp may be flushed with positive pressure by withdrawing the syringe from the injection cap while continuing to push fluid through the needle.
        3. Positive pressure is maintained while deaccessing a port by flushing the catheter while withdrawing the needle from the septum.

e. Prior to each access, the site should be examined for complications, including examination of the veins of the ipsilateral chest and neck, which might be indicative of venous thrombosis (Brown et al., 2001).

6. Removal technique
    a. Procedure usually is performed in the operating room; however, may be performed in an outpatient setting.
    b. A cut-down procedure is used to remove the port from the port pocket.
    c. The catheter is removed as described previously and the port incision reclosed.

7. Maintenance and care (see Section II, A-4, page 5, and Tables 2 and 3 in the original guideline document)
8. Complications (see the "Potential Harms" field for a summary of complications or see Section II, A-6, page 12 in the original guideline document)
9. Education and documentation (see Section VIII, page 80, and Tables 4 and 5 in the original guideline document)

Apheresis/Hemodialysis Catheters

1. Description and types (See the original guideline document for full details.)
2. Advantages and disadvantages (see Table 6 in the original guideline document for full details)
3. Patient selection criteria are based on type of therapy or indications for use.
    a. Patients who require apheresis of blood components, including stem cells, to be used with peripheral blood stem cell transplant. A temporary catheter may be used for collection of stem cells from allogeneic donors who have poor peripheral venous access.
    b. Patients who require leukopheresis of white blood cells
    c. Patients who require plasmapheresis of plasma
    d. Patients who require hemodialysis for management of acute and chronic renal failure
    e. Patients who may need venous access for continuous arterial venous hemodialysis (CAVHD), ultrafiltration, or continuous veno-venous hemodialysis (CVVHD).

4. Insertion techniques (see Section II, F-5, page 41, on nontunneled catheters or Section II, G-4, page 44, on tunneled catheters in the original guideline document)
5. Removal techniques (see Section II, F-7, page 42, on nontunneled catheters or Section II, G-5, page 44, on tunneled catheters in the original guideline document)
6. Maintenance and care (see Section II, A-4, page 5, and Tables 2 and 3 in the original guideline document)
7. Complications (see the "Potential Harms" field for a summary of complications or see Section II, A-6, page 12 in the original guideline document)
8. Education and documentation (see Section VIII, page 80 in the original guideline document)

Arterial Access Devices

1. Description and types of devices (See the original guideline document for full details.)
2. Advantages and disadvantages of arterial therapy
    a. Advantages
        1. Regional perfusion is useful only when the entire tumor is perfused and infusate can be confined to a specific area (Weinstein, "(Intravenous therapy," 2001). Efforts are being made to further restrict systemic circulation of infusate using techniques such as arterial, mechanical, or chemical embolization (Alsowmely & Hodgson, 2002).
        2. Only in the case of hepatic perfusion may access be achieved through the hepatic artery, as well as through the portal vein, and consideration is being given to use both accesses for drug delivery to the tumor (Paku et al., 1998).
        3. Increased exposure of tumor to drug increases tumor response, whereas less systemic circulation and exposure to infusate decreases risk of systemic side effects (Dizon & Kemeny, 2002; Goodman, 2000; Haller, 2000; Kemeny, 2000).

    b. Disadvantages
        1. Less systemic circulation and exposure to infusate increases the risk for distant metastasis.
        2. Positive outcomes from arterial therapy, such as improved survival and quality of life, remain under continued investigation (Haller, 2000; Kemeny, 2000).

3. Patient selection criteria
    a. Devices are available for children and adults.
    b. Assess patient condition, venous and arterial infusion device history, and type and duration of all antitumor therapy (INS, 2000).
    c. Consider any age-related factors and comorbidities for the procedure, surgery, or drug administration.
    d. Indications for arterial access device placement are as follows.
        1. Regional perfusions for adjuvant, cure, control, and palliative therapies
        2. Accessible artery supplying entire tumor
        3. Indications for long-term catheter placement
            a. Disease is confined to area of perfusion.
            b. Patient has adequate performance status and ability to tolerate surgical procedure.

        4. Percutaneous hepatic artery temporary catheter placement (Habbe et al., 1998)
            a. The liver is the focal point of disease, although extrahepatic metastatic disease may be present (Bergsland & Venook, 2000).
            b. Patient's clinical status precludes undergoing surgery.
            c. Evaluate tumor response before placing a permanent device.

    e. Check for sites of organ or regional perfusion for malignant disease with arterial access (see Table 8 in the original guideline document).

f. Consider contraindications for arterial access.
    1. Acute infection, prolonged fever, and absolute neutrophil count $<1{,}500\ mm^3$
    2. Severe coagulopathy

4. Patient setting
    a. Percutaneous placements and infusions usually are performed as an inpatient procedure, but they may be performed as an outpatient procedure.
    b. Bolus injections/infusions through a longterm catheter or port may be performed in an ambulatory setting, including the home, if nursing support is provided.
    c. Homecare and visiting nurses must be knowledgeable about the following.
        1. Arterial infusions and administration techniques
        2. Chemotherapy and side effects
        3. Safe handling of cytotoxic drugs by family and healthcare professionals
        4. Twenty-four-hour on-call assistance for pump failure or complications

5. Insertion procedures and perfusion checks (Arru et al., 2000)
    a. Direct arterial access can be performed at the time of initial tumor resection or during a second surgical procedure. Although commonly viewed as a permanent catheter, it may be removed if a specific surgical technique is used (Maruyama et al., 1999).
        1. Advantages of catheter placement during the initial surgery include the following.
            a. Catheter can be sutured in place, reducing the risk of catheter migration and displacement.
            b. Vessels can be viewed directly.
            c. Accessory vessels can be ligated (i.e., during hepatic perfusion, the right gastric artery is ligated to prevent perfusion of cytotoxic drugs to the stomach with resultant erosion).
            d. Gallbladder can be removed before hepatic arterial perfusion to prevent biliary sclerosis and cholangitis.

        2. Disadvantages of surgical catheter placement involve the stress and recovery period because of surgery.

    b. Percutaneous access with a local anesthetic is accomplished in the radiology department.
        1. Percutaneous access provides the advantage of excluding a surgical procedure and its cost and potential postoperative complications.
        2. Accessory vessels also can be ligated successfully (Habbe et al., 1998).
        3. A newer technique uses a fixed-tip catheter, reducing migration (Irie, 2001; Seki et al., 1999). In the fixed-tip catheter placement, the open end of the catheter is attached to the gastroduodenal artery with microcoils that also discontinue

blood flow to this artery and occlude the open end of the catheter. A side hole in this catheter is located in the hepatic artery, which is the desired location for drug administration.

4. Catheter may be inserted percutaneously and connected to an SC port (Seki et al., 1999).
5. Disadvantages to percutaneous access include the following.
    a. An inability to suture the catheter to the vessel exists, increasing the potential for catheter migration.
    b. Catheter is not long-term, so percutaneous access may require repeated catheter insertions for subsequent treatment.
    c. It possibly precludes ability to ligate other vessels.

c. Port placement (see Section II-H-4, page 46 in the original guideline document)
    1. Port is attached or preconnected to a long-term catheter.
    2. Port is placed in SC pocket and sutured to underlying fascia.
    3. The port pocket usually is placed over a bony prominence in the upper chest wall area or in the lower abdomen, but it can be placed anywhere on the trunk.
    4. Pocket incision should not transverse the septum.

d. Perfusion check
    1. Intraoperatively, adequacy of hepatic perfusion is checked to ensure absence of extrahepatic or accessory organ perfusion using intra-arterial injection of fluorescein dye and Woods lamp (Curley et al., 1993).
    2. Perfusion checks confirm permanent catheter patency and extent of perfusion. Checks are performed postoperatively, before cytotoxic therapy and every three months (Martin, 2002).

6. Postoperative care
    a. Surgically placed external catheter
        1. Assess exit site for drainage, edema, erythema, and catheter connections. Assess patient for pain.
        2. Measure external catheter length to obtain baseline measurement. This measurement is used to determine if the catheter is becoming dislodged.
        3. Ensure catheter connections or cap are Luer-locked and firmly connected.

    b. Surgically placed internal catheter connected to port or implanted pump
        1. Assess port or pump site for drainage, edema, and erythema. Assess patient for pain.
        2. Antibiotics are given intravenously, prophylactically before and after surgery.

    c. Percutaneous arterial catheter insertion

1. Heparin may be continuously infused to maintain artery patency. Blood coagulation values, such as partial thromboplastin time (PTT), should be monitored closely.
2. Catheter migration or dislodgment may impede blood supply to the limb. Assessment is made of the limb, which is supplied by the artery used for the catheter insertion, such as the leg if the femoral artery is used.
    a. The involved limb is assessed for pulse, color, temperature, capillary refill, numbness or tingling, edema, or hematoma. The specific insertion site determines any additional observations (i.e., a carotid artery insertion indicates the patient's neurologic signs are monitored for potential seizures) (West, 1998).
    b. Assess the catheter and exit site for catheter kinking, leaking, or migration; site bleeding; or hematoma.
    c. Frequency of assessment varies, and further research is warranted. Assessment frequency ranges from every four hours to every 15 minutes for one hour, every 30 minutes for 3 hours, every one hour for four hours, and then every four hours (Almadrones, Campana, & Dantis, 1995; Lynes, 1993).

d. Dressing: If oozing, use gauze and change every 24 hours or more frequently. If dry, use transparent semipermeable dressing. No ointments are applied to the site (O'Grady et al., 2002).
e. Brachial access-arm is secured in sling
f. Femoral artery access
    1. To decrease the chance of dislodgment, patient may be required to lie flat with a pressure dressing over insertion site. Use a loose restraint around ankle to remind patient not to move leg, and provide appropriate care for immobilization. Careful ambulation may be permitted in some settings (Habbe et al., 1998).
    2. Antiembolic stockings are recommended to decrease risk of thrombus (West, 1998).
    3. Hemodynamic monitoring and venipuncture should not be performed on the involved extremity except with physician order (INS, 2000).
    4. Ensure catheter connections or cap are Luer-locked and firmly connected.

7. Removal
    a. Long-term external catheter: May be in place indefinitely. The catheter may be removed by a surgeon. The catheter is tied off and buried SC by surgeon (Maruyama et al., 1999).
    b. Port: May be in place indefinitely. The port may be removed using a local anesthetic, and the catheter is tied off and buried subcutaneously by a surgeon.
    c. Percutaneous catheter: The catheter is removed in radiology or at the bedside with close observation by a surgeon. It is usually removed after four days or, at the maximum, seven days.

1. Apply pressure for 10 minutes over exit site or until bleeding stops.
2. Apply povidone-iodine ointment or a triple-antibiotic ointment to the site, cover with gauze, and apply an adhesive, occlusive pressure dressing.
3. Place a small sandbag over the site for eight hours.
4. Monitor for bleeding or edema at site, and check extremity pulse, skin color, and temperature changes every 10 minutes six times, then every 30 minutes two times, and then hourly six times. After eight hours, change the pressure dressing to an occlusive bandage (INS, 2000).

8. Drug delivery with arterial access
    a. Determine catheter placement and perfusion area.
        1. If sutured, perform perfusion check every three months or more frequently if regional side effects exist, suggesting catheter migration.
        2. If not sutured, perform perfusion check every course or every other course unless regional side effects exist, suggesting catheter migration.

    b. Laboratory studies are conducted to monitor regional and systemic side effects of the infused drug.
        1. Area of perfusion and drugs used dictate type of studies that need to be conducted to monitor regional side effects (e.g., liver function tests for hepatic artery infusion).
        2. Monitoring for systemic side effects follows a similar pattern as if the drug was given systemically; thus assessment depends on the drug given.

    c. Infusates used in regional therapy include cytotoxic agents, lymphocytes, and tumor necrosis factor. Any drug can be delivered through an implanted port without concerns about drug-device biocompatibility because of the limited time of contact with the drug and port (Graham & Holohan, 1994).
    d. Administration schedule depends on specific protocol.
        1. Drugs may be given as a bolus, intermittent, or continuous long-term infusion using either external or implanted pumps. The drug administration may continue for a specified number of cycles or indefinitely until there is response or disease progression (Lorenz & Muller, 2000).
        2. Hepatic arterial infusions through a temporary percutaneous catheter often are for four days, then the catheter is pulled. The cycle is frequently repeated for several months (Copur et al., 2001).

    e. A pump is required for arterial infusions; this may be an implantable pump or an external pump (see Section VII, page 73 in the original guideline document).
    f. Arterial access devices are not to be used for other therapies (e.g., total parenteral nutrition, lipid administration).

9. Access, flushing, and dressing (see Table 9 and Appendix 7, page 127, in the original guideline document for an example of a practicum.)
    a. For proper use of these devices, the nurse should be familiar with the device, its features, patient- and drug-related considerations, and precautions provided by the manufacturer.
    b. Use aseptic technique for all care provided.
    c. Catheter access is at the hub.
        1. Clean catheter connection with 70% alcohol or povidone-iodine.
        2. Clamp catheter during tubing or cap changes.

    d. Port access
        1. See Section II-H-5, page 47 in the original guideline document, on accessing a port.
        2. Flush port to verify patency. The port should have a brisk blood return, allow easy flow of fluids, and cause no edema, pain, or erythema.
        3. Clinicians are divided on the practice of aspirating blood to verify needle placement because of the risk of occlusion after repeated aspirations. Research is needed in this area.
        4. Blood cannot be aspirated from catheters with a one-way valve design.
        5. When administering vesicants through a port: If no blood return or perfusion, radiographic check needs to be obtained to verify catheter placement.
        6. Interventions for painful needle sticks during port access are described previously (see Section II-B-4-c), page 26, in the original guideline document on peripheral IVs).

    e. Flushing to maintain patency
        1. Controversy exists related to the type, amount, and concentration of final flush solutions.
        2. For information on port flushing, see Table 9 in the original guideline document.
        3. Flushing for external catheters (see Table 9 in the original guideline document)
            a. Post-surgery: Usually instilled with 1,000 units of heparin/ml using 2 ml.
            b. During continuous drug infusions or for "keep open" purposes when drug infusion is completed, the type and amount of solution and rate may be the following.
                i. Use continuous normal saline.
                ii. Flush with heparin solution as ordered by physician to maintain catheter patency (Martin, 2002).

10. General practice issues
    a. Use pressure tubing, positive pressure pumps, and stopcocks with Luer locks.
    b. Always use positive pressure when withdrawing needle or clamp before withdrawing needle from injection cap.
    c. Never leave open to air; maintain a closed system.

d. If external catheter is capped, keep clamped to avoid retrograde blood flow.
e. Make sure dressing is secure. Loop catheter to dressing, and tape securely so catheter loop is not exposed to accidental pulling.
f. Arterial access devices for regional cytotoxic therapy are not used for blood sampling. Other arterial catheters (pulmonary artery catheter or radial artery catheter) often are used for blood sampling using specific techniques (Schallom, Bisch & Intravenous Nursing Society (INS), 2001).

11. Complications (see the "Potential Harms" field for a summary of complications or see the original guideline document for full details)
12. Education and documentation (see Section VIII, page 80 in the original guideline document)

Intraventricular Access Devices

1. Description of devices (See the original guideline document for full details.)
2. Advantages and disadvantages of intraventricular reservoir:
    a. Advantages
        1. Provides relatively painless access to the cerebrospinal fluid (CSF)
        2. Obviates the need for repeated spinal taps
        3. Permits consistent and predictable drug delivery through the CSF (Kosier & Minkler, 1999)
        4. Allows for measurement of intracranial pressure
        5. Can be used for multiple therapies, such as chemotherapy, antibiotics, antifungals, and pain medication
        6. Allows for sampling of CSF

    b. Disadvantages
        1. Requires surgical insertion
        2. Catheter may migrate.
        3. Expensive to implant
        4. May become infected

3. Patient selection criteria (West, 1998)
    a. Patients with malignant CSF leukemias or lymphomas, meningeal carcinomatosis, CSF infections, or chronic pain
    b. Patients who require intermittent administration of chemotherapy, antibiotics, antifungals, and/or analgesics into the CSF
    c. Patients who do not wish to undergo repeated spinal tap for CSF access

4. Insertion procedures
    a. The procedure is explained to the patient and/or significant others, and informed consent is obtained.
    b. The device is inserted while the patient is under local or general anesthesia (Berweiler, Krone, & Tonn, 1998).
        1. The patient is placed in a supine position and the area is cleaned and shaved.

2. A burr hole in made in the scalp, and the catheter is fed into the lateral ventricle of the brain.
3. The reservoir is surgically implanted subcutaneously under the scalp above the frontal lobe (Kosier & Minkler, 1999).
4. The skin over the reservoir is sutured. Care should be taken that the suture line does not cross the port of the device (Berweiler, Krone, & Tonn, 1998).
5. Usually, the surgeon accesses the reservoir intraoperatively to confirm the free flow of CSF (Kosier & Minkler, 1999).

c. Confirmation of placement is confirmed with x-ray, CT scan, or MRI. The tip of the catheter should be located in the frontal horn of the lateral ventricle or close to the foramen of Monro (Berweiler, Krone, & Tonn, 1998).

5. Postoperative care
   a. A pressure dressing is placed over the operative site in surgery and should remain in place for at least 24 hours; afterward a gauze and tape dressing is applied for several days, then the wound left open to the air.
   b. The site should be monitored for bleeding, leakage of CSF, and excessive edema.
   c. Monitor and notify the physician for neurologic changes, such as headache, vomiting, cognitive changes, blurred vision, increasing lethargy, changes in neurologic signs, or speech difficulties.
   d. Monitor and notify the physician for signs of infection, including fever, stiff neck, or headache. Some physicians may order prophylactic antibiotics to prevent infection prior to insertion and for several days afterward (Webster, 2001).
   e. The reservoir can be used 48 hours following insertion (Fischer, Knobf, & Durivage, 1997).
   f. Sutures will need to be removed in 7-10 days (Fischer, Knobf,& Durivage, 1997).
   g. The patient may shower prior to the sutures being removed, if the area is kept covered (Kosier & Minkler, 1999).
   h. The patient should be advised to avoid trauma to the area in order to prevent damage to the reservoir.

6. Removal of device
   a. An intraventricular reservoir is rarely removed once implanted unless the device malfunctions or the body develops an infection that cannot be resolved with the device in place.
   b. Intraventricular reservoirs must be removed in surgery.
   c. Intraventricular reservoirs may be removed if implanted for the purpose of delivering prophylactic therapy only.

7. Access, dressing, and flushing procedures
   a. The physician generally accesses the intraventricular reservoirs. In some states, specially trained RNs may access the device in accordance with the individual's State Board of Nursing Practice Act.
   b. Access is a sterile procedure to reduce the risk of CSF infection (Kosier & Minkler, 1999).

c. Preservative-free drugs and diluent must be used at all times to prevent meningeal irritation (Kosier & Minkler, 1999).
d. Use of a 25-gauge or smaller needle will preserve the integrity of the dome.
e. Although intraventricular administration of the drug minimizes systemic side effects, some patients may require an antiemetic prior to the procedure if antineoplastics are to be given.
    1. Explain the procedure to the patient.
    2. Assess the patient's vital signs and neurologic status.
    3. Wash hands and assemble all equipment for drug injection and/or CSF sampling.
        a. Sterile field
        b. 25-gauge butterfly needle with attached extension tubing
        c. Sterile 2 x 2 gauze
        d. Syringe with medication to be infused
        e. Three alcohol swab sticks
        f. Three povidone-iodine swab sticks
        g. Sterile gloves
        h. CSF sample containers
        i. Syringe for withdrawing CSF
        j. Razor to shave area, if necessary

    4. Ensure that patient is comfortable.
        a. Place patient in a supine or semirecumbent position.
        b. The patient may be positioned in a sitting position if more comfortable (Goodman, 2000).
        c. Support head of patient on pillow.

    5. Shave area over reservoir, if necessary (Goodman, 2000).
    6. Prepare a sterile field and open equipment.
    7. Examine area over reservoir for signs of infection or trauma.
    8. Gently palpate the reservoir. It should be possible to feel the reservoir filling with CSF when gently depressed and the fingers left in place. If the reservoir does not refill or refills very slowly when depressed, notify the physician. X-ray may be indicated to evaluate position of dome or catheter (Kosier & Minkler, 1999).
    9. Using three alcohol swabs, cleanse the area over the site in a circular motion, beginning with the center and moving outward, and avoid covering the same area twice with the same swab.
    10. Repeat with the three povidone-iodine swab sticks.
    11. Allow povidone-iodine to air dry for 30 seconds.
    12. Insert the butterfly needle at a 45° angle into the reservoir.
    13. Attach a syringe to the extension tubing. CSF should flow freely into the syringe. Withdraw CSF equal to the amount of drug to be infused--reserving 3 ml to use as flush following the procedure--and set aside on a sterile field, maintaining the sterility of the syringe. Never forcibly aspirate, although gentle aspiration is not contraindicated (Goodman, 2000).
        a. If CSF is bloody or cloudy: Preserve the specimen, notify the doctor, and stop the procedure.

b. If CSF is clear, attach syringe with medication. Slowly and gently infuse medication over 5-10 minutes.
c. Following medication, flush with reserved CSF (Kosier & Minkler, 1999).

14. Remove needle, and apply gentle pressure with a sterile 2 x 2 gauze.
15. Gently pump the reservoir 3-5 times to help distribute the drug. When CSF flow is adequate, the half-time of drug from the reservoir to the cisterna magnum is 60 minutes. Slowing of central nervous system (CNS) fluid because of device malfunction can lead to decreased distribution of drug and increased CNS toxicity (Levin, Leibel, & Gutin, 1997).
    a. The patient may hear a whooshing or squishing sound when the reservoir is pumped (Goodman, 2000).
    b. The patient may experience headache, nausea, and dizziness.

16. Instruct the patient to remain supine or semi-recumbent for 30 minutes following the procedure.
17. Obtain vital signs, and assess neurologic status following the procedure.

f. No heparinization or flushing is necessary, as there is no blood in the system and the free-flow of CSF through the system should keep the catheter patent (Webster, 2001).
g. No dressing is required over the reservoir after the immediate postoperative period.

8. Complications (see the "Potential Harms" field for a summary of complications or see the original guideline document for full details)
9. Patient education
    a. Care of device
        1. Avoid getting incision wet while sutures are present.
        2. No care is required once sutures are removed.
        3. Hair is allowed to grow back, except for a small 2-3 cm area over the device.
        4. Avoid trauma to the device to prevent damage to reservoir.

    b. Signs and symptoms of infection (Fischer, Knobf, & Durivage, 1997; Goodman, 2000)
        1. Site tenderness, warmth, erythema, or drainage
        2. Fever
        3. Headache with or without vomiting, neck stiffness
        4. Bloody or purulent CSF from reservoir
        5. Blurred vision

    c. Signs and symptoms of catheter malfunction
        1. Nausea and vomiting
        2. Ataxia or slurred speech
        3. Change in mentation or level of consciousness

10. Education and documentation (see Section VIII, page 80 in the original guideline document)

Epidural and Intrathecal Access Devices

1. Purpose (See the original guideline document for full details)
2. Description of access devices (See the original guideline document for full details.)
3. Placement
    a. Patient preparation: Preplacement assessment of the patient. The procedure is explained to the patient and informed consent is obtained.
    b. Area of insertion is cleaned.
        1. Ten percent povidone-iodine and 0.5% chlorhexidine have been shown to be effective as cleansing agents.
            a. In 96 temporary epidural catheter insertions, chlorhexidine was found to have reduced risk of infection when compared to povidone-iodine (Kinirons et al., 2001).
            b. In 62 temporary epidural catheters, no difference was found between 0.5% solution of chlorhexidine and 10% povidone-iodine in reducing temporary catheter infection from insertion (Kasuda et al., 2002).

        2. Ten percent povidone-iodine, chlorhexidine, and alcohol all have the potential to be toxic to the CNS if introduced during access.
        3. Protocols need to emphasize vigorous scrubbing techniques and to decrease the amount of solution at the insertion site. Commercially available pledgets impregnated with povidone-iodine have been found to introduce the least amount of disinfectant into the epidural space when compared with povidone-iodine-soaked gauze and swab sticks (Paice, DuPen, & Schwertz, 1999).
        4. Sterile water can be used after povidone-iodine dries to decrease the introduction of cleansing solution into the epidural space (Paice, DuPen, & Schwertz, 1999).

    c. Epidural and intrathecal port placement
        1. Placement is performed in the operating room with the patient under local anesthesia.
        2. Patient is placed in a lateral decubitus position.
        3. Catheter is inserted percutaneously into the epidural space approximately 4 cm, usually through the second and third lumbar interspace (Kasuda et al., 2002; Kinirons et al., 2001; Smitt et al., 1998).
            a. Dura mater is the most exterior membrane covering the spinal cord, which forms the inner border of the epidural space. The ligamentum flavum and periosteum of the vertebral column form the outer border. The epidural space is a potential space between these boundaries.

b. Epidural space extends from the foramen magnum to the sacral hiatus.
c. Contents of the epidural space are composed of adipose and connective tissue, as well as blood vessels.
d. For intrathecal administration, the catheter is advanced below the dura where cerebral spinal fluid circulates.
e. The route of delivery into the subarachnoid space is termed intrathecal administration (Mercadante, 1999).
f. The potency of opioid is approximately 10 times greater when injected into the intrathecal space as compared to the epidural space (Mercandante, 1999).

4. The proximal end of the catheter is subcutaneously tunneled around the flank to the abdomen or anterior chest wall and connected to the portal body.
5. The portal body is sutured to the fascia over a bony prominence, such as the lower rib.

d. A temporary catheter may be placed for up to seven days.
    1. It may be inserted at the bedside or in the operating room using local anesthesia and placed into the epidural space or intrathecal space of the spine.
    2. External portion is taped up the patient's back to the anterior chest wall or around the flank and taped to the abdomen.

e. Tunneled catheter
    1. Catheter is inserted in the operating room using local anesthesia, with the distal tip of the catheter inserted into the epidural or intrathecal space.
    2. Proximal tip is tunneled under the SC tissue, exiting at the waist or side of the abdomen.

f. SC implantable pump
    1. Pump is inserted in the operating room while the patient is under local anesthesia.
    2. Pump is implanted into a created SC pocket, and the catheter is tunneled and threaded into the intrathecal space

g. Immediate postoperative care
    1. Check dressing for bleeding or drainage.
    2. Assess site for hematoma or excessive postoperative edema.
    3. Change dressing daily until site is healed.
    4. Assess for paresthesia, which may result from contact of the catheter with neural tissue, neurotoxic drug administration, or spinal cord compression (Mercadante, 1999).
    5. Monitor blood pressure and pulse per postoperative routine and then every four hours until they are stable.

4. Advantages and disadvantages of epidural/intrathecal access devices (see Table 12 in the original guideline document for full details)
5. Patient selection for epidural and intrathecal access devices
    a. Patient has chronic intractable cancer pain.

b. Temporary catheter: Selected for short-term use for approximately seven days postoperatively or to administer test doses of epidural narcotics to evaluate if pain can be controlled by this route prior to implanting a long-term access.
c. Tunneled catheters, ports, or pumps: Selected for long-term use for patients with a life expectancy of months.

6. Nursing management (West, 1998)
    a. Specially trained nurses may administer epidural and intrathecal medications, as directed by the individual's State Board of Nursing Practice Act (Goodman, 2000).
    b. Nurses must be knowledgeable of the principles of epidural drug administration.
        1. Patients will be monitored and managed with the initial dose of opiate and with each subsequent increase in dose.
        2. Patients need to be weaned off other opioids while receiving epidural analgesia.
        3. Notify physician immediately for signs of systemic or local inflammation; tenderness or edema; leakage; bleeding; loss of skin integrity; change in neurologic status; unusual resistance upon infusion of fluids; or alteration of circulation, sensation, or mobility in lower extremities and complaints of paresthesia.
        4. Always use Luer-lock connections. Avoid tubing with injection ports, or place tape over any injection ports to prevent inadvertent administration of other drugs into the epidural/intrathecal catheter.
        5. With continuous infusion administration of medication, tape a tension loop of tubing to the patient's body to prevent accidental dislodgment.
        6. Only preservative-free normal saline or Elliott's B™ (Orphan Medical, Minnetonka, MN) solution may be administered. (Elliott's B solution is an artificial fluid that approximates the normal ionic composition of CSF.)
        7. Placement should be checked prior to drug administration by gently aspirating. If clear fluid is greater than 0.5 ml or if blood is obtained, notify physician and do not administer drug. The presence of CSF indicates that the catheter has punctured the dura, and the presence of blood may indicate that the catheter has punctured the vasculature.
        8. Patient should be assessed for symptoms of respiratory and CNS depression by monitoring the following.
            a. Quality and rate of respirations
            b. Breath sounds
            c. Color of lips and nail beds
            d. Level of consciousness, sensorium, and arousability
        9. Use of an apnea monitor or pulse oximeter is recommended for the first 24 hours because the risk of respiratory depression is highest during this period. Respiratory depression may not occur in patients who have been taking an opiate on a long-term basis.

a. Delayed respiratory depression usually occurs 3-12 hours after administration, but it can occur after as long as 24 hours.
b. Have an oral airway, Ambu bag, and naloxone hydrochloride at the bedside for management of respiratory depression.

10. All patients must have an IV line or Heplock in place for at least 24 hours for administration of naloxone, as needed.
11. Keep head of bed elevated 30 degrees.
12. Assess for signs and symptoms of urinary retention, pruritus, nausea, vomiting, and loss of sensation in lower extremities as indications of opioid toxicity or catheter migration.
13. Intensive homecare teaching is imperative to the patient and caregiver (Mercadante, 1999).
    a. Explain injection of medication technique, catheter care, dressing changes, infection precautions, and signs to report to the physician.
    b. Maintain frequent telephone contact or home visits.
    c. Intrathecal treatment is more suitable than epidural for home treatment because of lower doses and volume of drugs.

c. Routine maintenance and care (Dawson, 2001; Kasuda et al., 2002; McIntosh, Spaven, & Hagen, 1999; Paice, DuPen, & Schwertz, 1999) (see Appendix 9, page 129 in the original guideline document)
    1. Site cleansing with an antiseptic solution
        a. See previous information under Placement.
        b. Studies with epidural and intrathecal catheters have focused on insertion and not on cleansing the port or pump site for access. Results are mixed between povidone-iodine and chlorhexidine (Kasuda et al., 2002; Kinirons et al., 2001).
    2. Dressing changes
        a. See previous description of gauze and transparent dressings in Section II-A, page 3 in the original guideline document.
        b. Authors of one study (Mann et al., 2001) found chlorhexidine impregnated dressing to reduce bacterial colonization of epidural short-term catheter exit sites.
    3. Flushing
        a. Catheter (temporary and permanent): 1-2 ml of preservative-free normal saline after use
        b. Port: 3 ml of preservative-free normal saline after use
        c. Pump: No flushing required
        d. Routine flushing not necessary because tip in CSF
        e. Daily site inspection for drainage, erythema, and edema
        f. Solutions: Researchers of one study used preservative-free epidural solution up to 14 days without an occurrence of an infection (McIntosh, Spaven, & Haven, 1999).

d. Administering analgesics through catheter or port (see Section VII, page 73 in the original guideline document)
    1. Access using procedure described previously for venous ports and tunneled catheters, with the exception of using sterile gloves (Goodman, 2000).
    2. Gently aspirate 1 ml. If blood or greater than 0.5 ml of CSF is aspirated, notify the physician and do not administer drug.
    3. Slowly and steadily inject the medication.
    4. Flush the catheter with 1-2 ml of preservative- free normal saline, and the port may be flushed with up to 3 ml of preservative-free normal saline to ensure medication has reached epidural or intrathecal space.

e. Filter and injection cap change: A filter may not be required if the drug is filtered prior to drug administration or if the portal body contains a filter.
    1. Change filter (60 micron) and injection cap every week or more frequently if damage or leaks occur.
    2. Wash hands.
    3. Prepare appropriate equipment for the procedure.
    4. Apply sterile gloves.
    5. Attach the new injection cap to the new filter, and flush the system with preservative-free normal saline.
    6. Clean the connection between the catheter and the filter with a povidone-iodine swab, allowing it to dry completely.
    7. If any excess exists, remove with sterile gauze.
    8. Remove old filter and injection cap.
    9. Screw on the new filter and injection cap securely.
    10. Place a label saying "epidural" or "intrathecal" around the tubing near the hub.

f. Contact homecare agency for follow-up and patient support, if appropriate.

7. Complications (see the "Potential Harms" field for a summary of complications or see the original guideline document for full details)
8. Education and documentation (see Section VIII, page 80 in the original guideline document)

<u>Intraperitoneal Catheters</u>

1. Description of device (See the original guideline document for full details.)
2. Advantages and disadvantages of catheter selection (see Table 13 in the original guideline document for full details)
3. Patient selection criteria
    a. Patients receive intraperitoneal (IP) therapy for the following malignancies.
        1. Ovarian cancer (Makhija et al., 2001)
            a. Microscopic residual disease (less than or equal to 0.5 cm) after initial surgical debulking
            b. Consolidation therapy after conventional IV therapy or after negative second-look surgery

c. Extended therapy after second-look exploration for patients with small volume residual disease (less than or equal to 0.5 cm)
d. Tumor confined to the peritoneum

2. Gastrointestinal malignancies (Horsell et al., 1999)
    a. Initial treatment in patients with small-volume IP disease
    b. Adjuvant therapy for patients with a high risk of relapse

3. Mesothelioma that is limited to the peritoneum (Mongero et al., 1999)
4. Palliative treatment for ascites in gynecologic, gastrointestinal, lymphoma, lung, and breast cancers

b. Patient characteristics
    1. Patients should be free of abdominal adhesions, which would limit even distribution of IP therapy (Berek, 2000).
        a. If inserted during initial surgical exploration, therapy should begin within seven days (Berek, 2000).
        b. Peritoneal distribution can be checked in radiology department by inserting radiopaque dye diluted in 2 liters of fluid, followed by computed tomography scan of the abdomen (Berek, 2000).
    2. Patients must have the physical and cognitive ability to care for a catheter or have a significant other provide care.
    3. Patient should be able to tolerate large volumes of IP fluid.
    4. Types of IP therapy: IP chemotherapy is still controversial and is not the standard of care because of toxicities, technical difficulties of delivery, and absence of taxane-era randomized data (Makhija et al., 2001). IP chemotherapy has not shown an increase in overall survival versus conventional therapy, except in patients with stage III ovarian cancer.
        a. IP chemotherapy delivers a high concentration of drug directly to the peritoneal space. Drugs that achieve the best peritoneal/plasma concentration ratio are those that have a high molecular weight, extensive first pass hepatic inactivation, and rapid plasma clearance (Makhija et al., 2001).
        b. Chemotherapy can directly penetrate into the tumor by means of free surface diffusion and through the blood vessels that nourish the tumor.
        c. Drugs can be given in higher doses than intravenous route, providing prolonged tumor exposure with decreased systemic effect (as the majority of drug is detoxified by the liver) to minimize the appearance of drug-resistant cells and to obtain higher clinical response.
        d. Drug remains in the peritoneal cavity according to the drug clearance properties (Sakuragi et al., 2000).
            i. Drugs used are specific to the disease being treated.

ii. Drugs considered venous irritants and vesicants have a similar effect on the peritoneum, causing pain, burning, and sclerosing. They may be chosen for their sclerosing effect rather than their antineoplastic effect (Walczak & Heckman, 1999).
iii. Drugs that have a high local toxicity that causes pain and the tendency to create adhesions are not used for planned multiple-course therapies (Walczak & Heckman, 1999).
iv. IP administration of biologic response modifiers, such as interferon, interleukin-2, and tumor necrosis factor, has been researched extensively. Rationale for use is the enhancement of the immune system and for cytotoxic effect. They may be given in combination with chemotherapy (Hirte et al., 1997; Sartori et al., 2001).

e. Drainage of chronic ascites accumulation in the palliative setting for gynecologic, gastrointestinal, lymphoma, and other cancers. Patients experience severe discomfort from fluid accumulation, as evidenced by shortness of breath, inability to eat, decreased mobility, abdominal pain, and fatigue (Eriksson & Frazier, 2000).
v. Patient has intractable ascites that requires multiple paracentesis.
vi. Ascites fluid must be clear, nonmucinous.
vii. Prognosis must be greater than one month.
viii. Benefits of IP catheter must outweigh risks.
ix. Patient and family must be able to care for the external catheter.

4. Insertion procedures
   a. External tunneled catheters (Coles & Williams, 2000)
      1. Consent form is obtained.
      2. Catheter can be placed at the time of the initial surgical exploration for the disease, laparoscopically under general anesthesia, or as a separate surgical procedure under local anesthesia, with or without IV sedation. Omentectomy is highly recommended (Reissman et al., 1998), if not already performed during the initial cancer surgery.
      3. The catheter is placed through the anterior abdominal wall at the level of the umbilicus.
      4. The entire IP segment of the catheter, with its multiple exit holes, must be placed in the peritoneum to avoid drug extravasation. The tip of the catheter is directed toward the cul de sac of the pelvis (Berek, 2000).
      5. After closure of the peritoneum, an SC tunnel is made to minimize infection and prevent dislodgment.
      6. The external portion of the catheter is placed away from the initial puncture site and sutured in place until adequate healing around the cuff occurs.
      7. The external catheter is placed off the side of the midline and away from the belt line to provide easy access for the patient.

8. Dacron cuffs are placed as previously described. Single Dacron cuff catheters are used primarily in oncologic situations because of the decreased length of time they will be used (usually less than a year) and because the surgical placement is more simple. Both single- and double-cuff catheters have been shown to be equally effective in preventing infection (Eklund et al., 1997).

b. Implanted SC port (Makhija et al., 2001)
    1. The catheter can be placed during the initial surgical exploration for the disease, laparoscopically under general anesthesia, or as a separate surgical procedure under local anesthesia with or without sedation. Omentectomy is recommended.
    2. The IP catheter portion of the device is placed as it is in the external catheter procedure (see Section II-H, page 46 in the original guideline document).
    3. After closure of the peritoneum, an SC tunnel is made to the selected port site, preferably over a bony prominence (usually a lower rib) to stabilize access.

5. Postoperative care (Elkabir et al., 1999; Moore et al., 1998)
    a. Assessment of the patient for surgical complications
        1. Pain at the exit site: Administer analgesics. Pain resolves in five to seven days.
        2. Bleeding into the peritoneum: Patients may have continuous exchanges of 1 liter dialysate with no dwell time until the returned fluid is clear. Bleeding may be significant enough to require blood transfusions.
        3. Potential for bowel perforation: Assess patient for severe abdominal pain, fever, and tense abdomen. Monitor bowel sounds.
        4. Peritonitis: Assess patient for fever, nausea, vomiting, severe abdominal pain, and cloudy peritoneal fluid. If peritonitis is suspected, send cultures and administer antibiotics and analgesics as ordered.

    b. Assessment of catheter complications (Coles & Williams, 2000)
        1. Leakage around the exit site of the external catheter: Chemotherapy is avoided for five to seven days to minimize leakage. The first course of chemotherapy may be placed in 1,000-1,200 ml of fluid, with subsequent treatments in 2,000 ml when the area has completely healed (Gynecologic Oncology Group, 2001).
        2. Tunnel or exit site infection: Assess wound for drainage, erythema, and tenderness. Administer antibiotics as ordered. Maintain aseptic technique when caring for the catheter.
        3. Catheter dislodgment: Assess patient for abdominal pain. Assess exit site for absence of sutures on the external catheter or for the presence of a visible Dacron cuff exuding from the skin. Notify physician of dislodgment of catheter. Implanted

port catheter dislodgment may be evidenced by an inability to flush or drain off fluid.
4. Nonfunctioning catheter: Assess ability to flush or withdraw peritoneal fluid. Reposition patient, and attempt to flush with sterile normal saline (NS). Administer heparin flush (10-100 units/ml). Notify physician of problem. Dye studies may be required to determine cause of problem.
5. Bleeding: Assess exit site dressing for bleeding. Apply pressure if necessary. Notify physician of excessive amount. Assess peritoneal fluid for blood. Patient may require flushing of the peritoneal cavity with a few cycles of dialysate or NS solution containing heparin (500 units/l) to minimize the chance of clotting in the catheter (Coles & Williams, 2000).

c. Education of the patient and family (Moore et al., 1998)
    1. Treatment regimen, rationale, side effects, and signs of infection (for both catheters)
    2. For external catheters: Exit site care, catheter care, and frequency of dressing and cap changes

6. Removal of devices
    a. External catheters can be removed at the bedside or in the operating room under local anesthesia. Late complications of abscesses at the exit site from the retained Dacron cuff if removed at the bedside have been documented. Therefore, when therapy is completed, it is recommended that the catheter be completely removed surgically to prevent long-term complications of catheter migration, abscess, or persistent tunnel infections (Elkabir et al., 1999; Ghosh, Geller, & Twiggs, 2000).
    b. Implanted SC ports require removal in the operating room under local anesthesia or may remain in place indefinitely.

7. Maintenance care (Gynecologic Oncology Group, 2001) (see Appendix 10, page 130 in the original guideline document)
    a. Aseptic technique is required to prevent catheter tunnel infection and peritonitis. All equipment must be sterile. Use of sterile mask and gloves is highly recommended because of the vulnerability of the patient population to infection (Lee, Lau, & Yeong, 2000; Murphy & Rossi, 1995).
    b. External catheters are accessed with needleless (or needle-free) system.
        1. Open supplies, including syringe, needleless connections, catheter cap and catheter clamp, gauze, gloves, and mask, onto a sterile field.
        2. Cleanse exit site, catheter, and catheter cap using povidone-iodine swabs in an outward spiral fashion, being careful not to go over the same area twice. Allow to air dry. Alcohol or acetone-based cleaning solutions are not recommended, as they are incompatible with the polymer material used to develop these catheters (Corpack Medsystems, 2001; Vas-Cath, 1988).

3. Change the sterile needleless cap before connecting infusion tubing.
4. Flush catheter with 20 ml sterile NS to ensure patency.
5. Withdraw peritoneal specimen for testing as ordered. Assess characteristics of fluid.
6. Connect patient to infusion tubing; start infusion and assess for leakage, ease of flow, SC infiltration, and pain.
7. Apply occlusive dressing, and anchor tubing with a stress loop to prevent excess pulling.
8. Administer treatment as ordered.

c. Implanted port requires noncoring needle to access (Gynecologic Oncology Group, 2001).
    1. Open supplies, including syringe, noncoring needle, catheter cap, gauze, mask, and gloves into a sterile field.
    2. Draw up 20 ml sterile NS aseptically, attach needleless cap to noncoring needle tubing, and prime with NS.
    3. Cleanse access site with cleansing agent.
    4. After inserting needle into port (see page 47 of the original guideline document), flush with 20 ml sterile NS to ensure patency. Assess for leakage, ease of flow, SC infiltration, and pain. Withdraw peritoneal specimen as ordered.
    5. Connect patient to infusion tubing: Start infusion and assess for SC infiltration, leakage, ease of flow, and pain.
    6. Apply occlusive dressing, and anchor tubing with a stress loop to prevent excess pulling.
    7. Administer treatment as ordered.

d. After treatment is complete, the catheter is clamped. Fluid dwells in abdomen for length of time ordered by physician, usually four to six hours.
e. Fluid may be drained off or allowed to absorb per physician order.
f. The external catheter is flushed aseptically with 20 ml sterile NS. The implanted port is flushed with 20 ml sterile heparinized saline (10–100 units/ml) to maintain a heparin lock in the portal chamber, and tubing is disconnected. It is also recommended that implanted peritoneal ports be flushed with heparin once a month per the manufacturer.
    1. The external catheter dressing remains in place for one week in the immediate postoperative period, unless excess soiling occurs. After the first week, dressings are changed three times a week; catheter caps and clamps are changed once a week.
    2. A new sterile dressing is placed over the access site of the implanted port after the needle is removed and remains in place for 48 hours.

8. General practice issues (Moore et al., 1998) (see the original guideline document for full details)
    a. Administration of IP fluids and medications
        1. Verify order and review patient labwork.
        2. Explain procedure to patient.

3. If ordered, insert indwelling urinary catheter to facilitate monitoring of intake and output. Place patient in semi-Fowler's position to promote comfort.
4. Establish IV line, and administer ancillary medication, including antiemetics. Although peritoneal drugs have fewer systemic effects than IV drugs, some of the drug crosses into the venous system, especially if IP drug is allowed to be absorbed instead of drained. Controlling systemic effects with IV drugs allows for significant dose escalation.
5. Drain fluid prior to infusion of chemotherapy so patients with large volumes of ascitic fluid may tolerate the therapy better.
6. Warm IP fluid to body temperature to minimize cramping and shivering by soaking IP fluid in warm bowl of water or using heating pad.
7. Infuse fluid as ordered, usually over 30 minutes to two hours. In adult patients, a minimum of 2 liters of fluid is required to ensure distribution of drug throughout the peritoneal cavity. Chemotherapy, placed in 1 liter of fluid, and 1 liter of NS is connected to dialysis tubing. The infusion is begun with 300 ml of NS, which allows the nurse to evaluate the ease of flow, presence of leakage, loculation, or extravasation. If no complications, the NS can be stopped, and the chemotherapy can be infused. The complete 1 liter of chemotherapy is given and followed by the remainder of the 1 liter of NS to flush the line. For infusions on sequential days, 1 liter of fluid is sufficient, because the peritoneal space can absorb approximately 1 liter of fluid in 24 hours.
8. When fluid has infused, close clamp for duration of dwell time, usually 4-6 hours. During that time, assist the patient to turn from side to side every 15-30 minutes to improve distribution throughout the abdomen.
9. After dwell time, if ordered, open drainage clamp and allow fluid to drain for 30 minutes to 2 hours. If fluid will not drain, attempt to reposition the patient, instruct patient in Valsalva maneuver, apply manual pressure to abdomen, or irrigate catheter with sterile NS. Drainage is more rapid with an external catheter, but the implanted port will allow drainage of 2 liters in about 1-2 hours.
10. Instruct patient, if an outpatient, to wear loose clothing with expandable waistline and to arrange for transportation home.
11. Disconnect all tubing as previously described. Apply new dressing.

b. Palliative use of the IP catheter for drainage of ascites in selected patients: Patients and families may be taught how to perform this procedure in the home with the support of homecare or hospice services (Lee, Lau, & Yeong, 2000; Murphy & Rossi, 1995).
    1. The catheter is accessed as previously described.
    2. Fluid is drained, using a needleless system, into a drainage bag, via gravity or with the use of vacuum bottles.
    3. Assess the patient's reaction to fluid drainage. A roller clamp may be used to adjust rate of drainage if patient becomes

orthostatic, as evidenced by complaints of light-headedness or dizziness, or experiences pain.
4. After drainage is complete, tubing is disconnected, with an occlusive dressing placed over the site, as previously described.
5. Education of the patient and family about the external catheter should include the following.
    a. Exit site, catheter, and cap care
    b. Dressing change three times a week, which can be done by the family
    c. Weekly cap and clamp change
    d. Implanted port does not require dressing change and access site cleaning when not in use. Family can be taught to access device.
    e. Signs and symptoms of infection
    f. Signs and symptoms to call physician

9. Complications (see the "Potential Harms" field for a summary of complications or see Table 14 in the original guideline document for full details)
10. Education and documentation (see Section VIII, page 80 in the original guideline document)

Implanted Pumps

1. Device description (See the original guideline document for full details.)
2. Advantages of continuous infusion therapy
    a. For all drugs, the peak and valley effect is eliminated.
    b. Infusion therapy achieves constant drug administration.
    c. Advantages for antineoplastic drugs include the following.
        1. Continuous drug administration over many cell cycles yields increased cell kill (Martin, 2002).
        2. A higher concentration of chemotherapy is delivered to the tumor than would be possible with systemic therapy (Kemeny & Fata, 2001; Medtronic Neurological, 2001).
        3. Less acute systemic toxicity occurs because smaller doses are infused regionally (Ensminger, 2002).

3. Patient selection and treatment criteria
    a. Patient can be a young adult or adult.
    b. Patient has sufficient body mass to hold implanted pump.
    c. Patient has adequate performance status and ability to tolerate surgical procedure.
    d. Patient has a disease and conditions that respond to continuous infusion therapy through an implanted pump (Civalleri et al., 1998; Damascelli et al., 1999; Ensminger, 2002; Heslin et al., 2001; Kemeny, 2001; West, 1998). Hepatic arterial infusion is the most common use for an implanted pump. Other indications:
        1. Colorectal cancer with liver metastasis
        2. Renal cell carcinoma
        3. Head and neck tumors
        4. Brain tumors
        5. Chronic pain conditions
        6. Neuromuscular spasticity and dystonia

e. Drugs used in an implanted pump must be Food and Drug Administration (FDA) approved for treatment of specific diseases.
    1. Examples of drugs approved for intra-arterial infusion include floxuridine, doxorubicin, methotrexate, bleomycin, cisplatin, 5-fluorouracil, amikacin, heparin, and glycerin.
    2. Examples of drugs approved for intrathecal infusion are morphine, clonidine, baclofen (Hildebrand, Elsberry, & Hassenbusch, 2003), and hydromorphone (Hildebrand, Elsberry, & Anderson, 2001). These solutions must be preservative-free.

f. Contraindications for pump implantation
    1. Large-volume infusions required.
    2. Disseminated disease contraindicated for regional therapy
    3. Brief life expectancy
    4. Evidence of infection (Medtronic Neurological, 2001)
    5. Programmable pump contraindicated
        a. When pump cannot be implanted less than 2.5 cm from surface
        b. When patient has another implanted, programmable device, such as a pacemaker

4. Patient setting
    a. Can be used in all settings by trained personnel (Manufacturer representatives are available resources.)
    b. Reimbursement
        1. Pump placement is usually reimbursable.
        2. Reimbursement for non-FDA approved uses must be considered on a case-by-case basis with each patient's insurance company. The insurer considers the research base for the route and drug regimen, as well as the patient's life expectancy.

5. Insertion procedures and perfusion checks (Curley et al., 1993)
    a. See appropriate sections for the insertion procedures of arterial (III) or intrathecal (V) catheters.
    b. Catheter insertion and pump implantation may be performed as separate procedures or during the initial tumor resection procedure.
    c. Pump implantation is performed in the operating room under anesthesia after obtaining informed consent.
    d. Pumps are most commonly inserted through an open surgical procedure. A laparoscopic technique can be used to insert pumps in the abdomen (Urbach et al., 2001).
    e. Pump reservoir is filled and catheter access port is flushed after connecting the catheter to the pump.
    f. Incision for pump pocket is approximately 8 cm long and is located in the lower left or right quadrant of abdomen, below umbilicus or in the infraclavicular fossa for head, neck, and brain tumors.
        1. The pump is placed in the subcutaneous pocket and sutured to the fascia with nonabsorbable sutures. To avoid stress on the suture line when the pump is accessed, the suture line should not transverse the center or secondary port septums.

2. The incision is closed and covered with a sterile dressing or pressure dressing.

g. The pump is initially accessed four to six days postoperatively.
h. A perfusion check is performed.
    1. Catheter tip placement and desired site of infusion are verified intraoperatively.
    2. Postoperative days four through six and before drug therapy is initiated, a perfusion study or x-ray is done to verify region of perfusion and catheter tip placement.

6. Postoperative care
    a. Assess implantation site for bleeding, drainage, swelling, or seroma.
    b. Maintain pressure dressing for 24 hours or until no bleeding is present.

7. Removal: The pump is removed in the operating room under local anesthesia, and the catheter is removed subcutaneously.
8. Patient education
    a. Patient should report any edema, fever, erythema, or pain at site (Medtronic Neurological, 2001).
    b. Provide patient with MedicAlert® (Turlock, CA) emblem, which alerts healthcare professionals in emergency situations, and a pump identification card for when the device triggers metal detectors.
    c. General activity restriction: Avoid sports or activities that might cause injury or dislodgment of pump.
    d. IsoMed pump: Avoid extended exposure to activities that may alter pump temperature and therefore pump flow rate (Medtronic Neurological, 2001).

9. General practice issues (Goodman, 2000; Martin, 2002; Medtronic Neurological, 2001; West, 1998)
    a. The nurse should be familiar with the device, drug-related complications, and demonstrate implanted pump access competency. Education materials and clinical representatives are available from the manufacturer.
    b. Identify the pump model number, reservoir size, and flow rate (Medtronic Neurological, 2001).
    c. Use aseptic technique when accessing the pump septum.
    d. Position the needle properly in the reservoir of the pump prior to drug instillation.
        1. Access the pump reservoir and not the secondary port.
        2. Improper injection through the secondary port (resulting in bolus administration) or into the subcutaneous tissue may result in precipitation, overdose, or extravasation (Medtronic Neurological, 2001).
        3. Incorrect needle placement may damage the segment of the catheter in the pump pocket.

    e. The pump must be refilled on a schedule. The interval depends on drug concentration, drug stability, pump reservoir volume, daily dose, and various treatment considerations. The pump should never become completely empty.

1. Drugs must be stable for the length of infusion time in the pump and compatible with the pump's composition material.
2. Bolus injections through the secondary port do not have the constraints of compatibility or stability because of the minimal contact time with the material and speed of infusion (Graham & Holohan, 1994).
3. Plan refill schedule, taking into account any office closures and patient vacations and holidays. The pump usually requires a refill every two weeks.

f. Overfilling the pump reservoir will result in over pressurization and over infusion of medication.
g. Drug dose calculations are as follows.
    1. Use manufacturer guidelines for calculating amount of drug needed to refill the pump (see Figure 9 in the original guideline document for an example of calculating an FUDR infusion refill).
    2. Intra-arterial infusion will require liver function tests prior to calculating dose.
    3. Calculate daily dosage needed.
    4. Calculate next refill date.

h. Fluid should return immediately after accessing. If fluid is not obtained after accessing reservoir, do the following.
    1. Verify the needle is through the septum and in the pump reservoir.
        a. Manually palpate pump features.
        b. Ensure the needle is against the stop.
        c. Check last refill date to ensure pump is not empty.
    2. If the septum cannot be located, notify a physician. An x-ray of the pump can verify its location.

i. Inform physician of the following situations.
    1. Inability to obtain fluid from the pump after access
    2. Signs and symptoms of infection
    3. Development of pump erosion or seroma

j. Document refill information.
    1. Date and time of refill
    2. Number of days since last refill
    3. Return volume from pump after access
    4. Infused volume (previous refill volume minus return volume)
    5. Pump flow rate (infused volume divided by number of days since last refill)
    6. Pump drug concentration
    7. Drug refill volume
    8. Injection via secondary port
    9. Patient's response to procedure

10. Access procedures (Medtronic Neurological, 2001) (see Figure 10 in the original guideline document)
    a. Supply kit contents and access/refill procedures for the Medtronic pumps are outlined in Table 17 in the original guideline document. A

programmer is necessary to change the flow rate of the SynchroMed pump. Adjusting the rate and obtaining printouts on the SynchroMed pump are beyond the scope of this module. Contact the manufacturer for this information.

b. Accessing the secondary port of either pump is similar to accessing an implanted port (see Section II-H, page 47 in the original guideline document). However, the precise procedure can be obtained through the manufacturer guidelines before accessing the port.
c. Solutions used for maintenance infusion or between drug intervals include the following.
    1. Intra-arterial: Heparinized NS (1,000 u/ml).
    2. Intrathecal: Preservative-free NS

d. The pumps require the use of a 22-gauge noncoring needle to preserve the integrity of the septum.

11. Complications (see the "Potential Harms" field for a summary of complications or see Table 18 in the original guideline document for full details)
12. Education and documentation (see Section VIII, page 80 in the original guideline document)

Education and Documentation Issues for Access Devices

1. Ensure that patient's or significant other's teaching about access device is documented in the healthcare record.
2. Nurse education and competency in caring for patients with access devices are documented in personnel records.

Controversial Issues

See the original guideline document and Table 19 for a summary of controversial issues.

CLINICAL ALGORITHM(S)

None provided

EVIDENCE SUPPORTING THE RECOMMENDATIONS

REFERENCES SUPPORTING THE RECOMMENDATIONS

References open in a new window

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The type of evidence is not specifically stated for each recommendation.

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

- Nurses properly educated and trained in the use of access devices should provide care, and instruction to the patient, that will result in a reduction in the number and type of complications associated with the use of access devices.
- The quality of life of patients with cancer has improved dramatically in the past decade with the development of access device technology.

POTENTIAL HARMS

Refer to Table 4 in the original guideline document for a list of general insertion complications of vascular access devices (VADs). The following is a summary of complications associated with specific devices. Refer to the original guideline document for full details.

Peripheral Intravenous Catheters

- Bleeding
- Vein injury
- Nerve injury
- Infiltration
- Phlebitis
- Thrombosis
- Infection

Subcutaneous (SC) Infusion Devices

- Local reaction including insertion site erythema, edema, induration, and pain/discomfort
- Leakage or pooling of fluid at the insertion site
- Obstruction
- Sloughing of tissue
- Infection
- Puncture of vessels
- Fluid overload

Midline Catheters

- Same as peripheral IV catheters above

Peripherally Inserted Central Catheters (PICCs)

- Refer to vascular access device section and Tables 4 and 5 in the original guideline document for details.

Central Venous Lines

- Refer to vascular access device section and Table 4 in the original guideline document for details.

Tunneled Central Venous Catheters (CVCs)

- Refer to vascular access device section and Tables 4 and 5 in the original guideline document for details.

Implanted Venous Port & Apheresis/Hemodialysis Catheters

- Refer to vascular access device section in the original guideline document for details.

Arterial Access Devices

- The most common complications are infection, catheter migration/dislodgment, occlusion/thrombosis, and bleeding at the exit site. Refer to Table 10 in the original guideline document for full details. In addition, less common complications include percutaneous arterial catheter leak, hepatic artery injury, arterial spasm during insertion or infusion, cerebral vascular accident, migrating embolization coils or microcoils, and skin reaction.

Intraventricular Access Devices

- Infection
- Malposition or migration of catheter
- Bleeding

Epidural and Intrathecal Access Devices

- Infection
- Malposition or migration of catheter
- Bleeding
- Disconnection of catheter from portal body
- Fibrosis formation
- Dislodgment of needle from port
- Erosion of port or pump through skin

Intraperitoneal Catheters

- Patient discomfort
- Inflow failure
- Outflow failure
- Drug extravasation
- Exit site infection
- Tunnel infection
- Peritonitis
- Slow infusion rate of solution
- Systemic toxicity of the chemotherapy administered
- Leakage at exit site
- Chemical peritonitis
- Sclerosing encapsulating peritonitis

Refer to Table 14 in the original guideline document for additional details.

Implanted Pumps

- Local reactions
- Catheter occlusion
- Equipment problems
- Infection
- Extravasation of vesicant
- Pump inversion in subcutaneous pocket
- Drug crystallization
- Skin necrosis over pump

Refer to Table 18 in the original guideline document for additional details.

CONTRAINDICATIONS

CONTRAINDICATIONS

- Alcohol- and iodine-containing products may be contraindicated for use to clean or come in contact with certain catheter materials and some types of protective caps. Contact may weaken or compromise the material over time.
- Use of heparin may be contraindicated in patients at risk for heparin-induced thrombocytopenia.
- If a nontunneled catheter is involved, a guidewire exchange of catheter may be contraindicated because the infection could be reintroduced into the bloodstream.
- Midline catheters are contraindicated for solutions with final concentrations >10% glucose or >5% protein.

Contraindications for Subcutaneous Infusion Devices

- If patient has generalized edema, poor peripheral circulation, or minimal subcutaneous (SC) tissue, although cachexia is not an absolute contraindication for subcutaneous infusion
- When rapid control of severe pain or frequent boluses or changes are needed
- If patient has a bleeding or coagulation disorder
- When rapid infusion or more than 3,000 ml/24 hours are required

Intravenous Therapy Planned Appropriate for Midline Catheter

- Contraindicated intravenous fluids include:
    - Continuous infusion of vesicants
    - Solutions with glucose concentration >10%
    - Solutions with protein concentration >5%
- Performing the Valsalva maneuver decreases the risk of air embolism during catheter removal. The maneuver is contraindicated in patients with increased intracranial pressure or if intubated.
    - Contraindications for arterial access:
        - Acute infection, prolonged fever, and absolute neutrophil count <1,500 mm^3
        - Severe coagulopathy
    - Contraindications for pump implantation

- Large-volume infusions required
- Disseminated disease contraindicated for regional therapy
- Brief life expectancy
- Evidence of infection
- Programmable pump contraindicated
    - When pump cannot be implanted less than 2.5 cm from surface
    - When patient has another implanted, programmable device, such as a pacemaker

QUALIFYING STATEMENTS

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IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

IMPLEMENTATION TOOLS

Staff Training/Competency Material

For information about availability, see the "Availability of Companion Documents" and "Patient Resources" fields below.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Getting Better
Living with Illness

IOM DOMAIN

Effectiveness
Patient-centeredness
Safety

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

Oncology Nursing Society (ONS). Access device guidelines: recommendations for nursing practice and education. 2nd ed. Pittsburgh (PA): Oncology Nursing Society (ONS); 2004. 141 p. [433 references]

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FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Not stated

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This is the current release of this guideline.

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GUIDELINE AVAILABILITY

Electronic copies: Not available at this time.

Print copies: Available for purchase from the Oncology Nursing Society, 125 Enterprise Drive, Pittsburgh, PA 15275-1214; telephone, 412-859-6100; fax, 412-921-6565. The ONS Publications Catalog is available online at the Oncology Nursing Society (ONS) Web site.

AVAILABILITY OF COMPANION DOCUMENTS

None available

PATIENT RESOURCES

None available

NGC STATUS

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